

R. North  
Works Vol. XIX  
Natural Philosophy  
BL Add MS 32546<sup>1</sup>

... I think it Impossible that any  
one Can understand, & Not beleev, all are of  
a kind, & that y<sup>e</sup> Same analogy of thing's runs thro  
y<sup>e</sup> whole world ...

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<sup>1</sup> Bound volume; external measurement, 220x255mm; ff. 1-18, 165x187-90mm; ff. 19-24, 140-5x182-5mm; ff. 25-32, 165x195mm; ff. 33-90, 165x205-10mm; ff. 91-111, 165x190-5mm; ff. 112-33, 165x205-10mm; ff. 134-41, 155x195mm; f. 142, 160x200mm; ff. 143-68, 165x205-10mm; ff. 169-93, 140x185-90mm; ff. 174-8, 160x190mm; ff. 178-9, 150x190mm; ff. 180-90, 180x235mm; ff. 191-4, 165x205-10mm; ff. 195-200, 165x210mm; ff. 201-6, 145x185-90mm; ff. 207-71, 140-45x180-90mm; ff. 271-3, 150x185mm; ff. 274-6, 160x200mm; f. 277, 140x180mm; ff. 278-83, 145-50x180-90mm; ff. 284-7, 165x205-10mm; f. 287, 150x190mm; f. 288-93, 160x200-10mm; ff. 294-98, 155x190mm; f. 299, 150x175mm; f. 300, 150-85mm; ff. 301-12 153-192mm; ff. 303-5, 155x190-200mm; ff. 306-7, 140x183mm; f. 308, 140x183mm; ff. 309-21, 165x205-10mm. See also further comments on appearance and condition throughout the footnotes, below.

<pencil, top LHS, '32546'; top RHS '1'>  
<centre of page BM stamp, red>

Method Regulated. 1. book. see  
1. part. - Generall Notions by way of intro=  
duction for a body of philosophy.-

perception; the Subject & Manner.  
viz<sup>t</sup>. Body; - 1<sup>st</sup>. singly Considered.

1. the properties.

Impenetrability  
Quantity or figure.  
Mathematicks,  
No Resulition or  
flexibilty.

2. Body in chang.

parts infrangible  
severall parts variable  
viz<sup>t</sup>. by Motion  
p<sup>r</sup>judices. &.  
Manner of Judging  
Capable of all  
variety's, consistent  
with impenetrability  
No Mixt Motion's  
Time.

Certein Abstracts.

Infinity  
Eternity  
vacuity

It being my porpose to set downe my sentiments concerning naturall thing's so ffarr as I have had invitation to bend my Thought's, I thinck it Expedient first to Scematize the method I shall walk by, w<sup>ch</sup> will lead me thro, & shew when I am at my Journey's End.

True method Consists not in breaking [de= diding?]<sup>3</sup> & subdeviding, but in placing things in Such order as Nature hath made them. as a picture ought to Represent that neerest w<sup>ch</sup> in ye life is so, and an history begin with the Eldest times w<sup>ch</sup> it Relates, so in comu= nicating sciences, wee ought to state thing's in The same Connexion and order, wherein wee understand, alwais p<sup>r</sup>ferring that w<sup>ch</sup> is least doubtdfull, and least dependant.

I desire to omitt nothing to make my Systeme Compleat, therefore must deal in other peoples inventions pretty largely, but to avoid the censure due to a plagiary, I make this acknowledgment, professing farther to be much shorter in Such thing's as I have learnt, then wherein I thinck my self the hinter.

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<sup>2</sup> RN's numbering begins on this page and reappears intermittently throughout the text of the *Method Regulated*.

<sup>3</sup> Where I am not sure of my reading of a word I have used square brackets and a question mark [?] - thus you will find it where the text becomes illegible (to me). Rather than salt the text with 'sic's I have also used [?] to indicate a form, or spelling, that puzzled me, even where I could read it, and thought it might have been a slip of RN's pen.

perception.  
 1. The Manner  
 2. The Matter  
   1. things perceiv<sup>d</sup>  
   2. their changes.  
     |  
     motion & Rest.  
   1. The Nature  
   2. the laws.  
     Time.  
       {Geometry  
Quantity.{arithmetick  
       {Algebra  
     Abstracts.  
   1. Infinity.  
   2. Space & place.  
   3. vacuity.  
 4. ~~Continuity.~~  
  
 Mechanicall  
 powers.  
  
 lever & ballance.  
 pulley.  
 weel & axis.  
 screw.  
 forcing of Water.  
 /Rules of impul=  
 ses.  
 1. Regular  
 2. Irregular.  
 Mistakes of  
 Authors.\

The first truth is, that wee doe perceive. then  
 it is naturall to inquire. 1. of the Manner, 2  
 of the subject matter; w<sup>ch</sup> latter produceth  
 2. Consideration's; 1. the nature of those things  
 wee perceiv. 2. the changes and variations  
 they admitt. under w<sup>ch</sup> last head are compre=  
 hended all the doctrine of motion, & Rest. w<sup>ch</sup>  
 is the foundation of all naturall knowledg. and  
 brancheth into./1.\ the nature of it, and .2. the  
 law's of it. the former gives an account of  
 Time, & the nature of it, w<sup>ch</sup> is a reconciling  
 contemplation. there are some notion's or abs=  
 tract's w<sup>ch</sup> I touch upon, tho not Essentiall  
 part's of the hypothesis, viz. Space and place.  
 vacuity. Infinity, & Eternity. ~~continuity & fluidity~~  
 All w<sup>ch</sup> are despatch't before I enter upon the  
 larg feild of the law's of motion. wherein is  
 plainly shewed the reason of all phenomena  
 of motion, the cheif whereof are the Efficacy  
 of Mechanicall powers. of w<sup>ch</sup> particular  
 instances are given, as proof's of the Hypothesis  
 viz. the lever or ballance. pulley. weel & axis.  
 wedg Screw, and the rules of raising water.  
 There is also set forth the nature of Reflection  
 Refraction, the rules of the impulses of all sorts  
 of body's as well Regular, as irregular. w<sup>ch</sup>  
 besides the particular's of those instances,  
 serve to y<sup>e</sup> Solution of many other phenomena  
 as Gravitation, pressure, & in particular that  
 of fluids. /with y<sup>e</sup> Mistakes of some author's Con=  
 cerning Motion.\

Systeme of  
the world.

Sun  
planets  
fixt starrs  
comets.

Gravitation

Air.  
Atmosphere.  
clouds  
Raine.  
See.  
water.

conatus  
[Rarefaction?]  
pressure.  
Baroscope.

Having dispatch't the Consideration of single  
body's I proceed to look abroad, and take the whole  
world in view, and argue for the copernicean Systeme  
improv'd by des Cartes,<sup>4</sup> I mean not all his minutia<sup>e</sup>  
but onely in his generall Idea, w<sup>ch</sup> I thinck Irrefra=  
gible. but coming to more particular matters  
as the nature of the sun, planet's comet's, &  
fixt starr's. wee are in a feild of Conjecture, where=  
in altho wee miss the truth, it doth not over=  
turne our designe, w<sup>ch</sup> is founded in generalls.  
but untill better Emerg, let these ceas our won=  
der, & temper our ignorance. The next topick  
Must be our owne habitation y<sup>e</sup> Earth, Environ'd  
with its atmosfere, w<sup>ch</sup> is y<sup>e</sup> air wee breath, its o=  
riginall, & nature, how soluble into water, from  
w<sup>ch</sup> it is derived; the pressure & spring of it. (ha=  
ving before given an account of Gravitation,  
& that w<sup>ch</sup> wee call conatus or pressure, and also  
of springs), w<sup>ch</sup> leads to a solution of the ba=  
roscope a new & excellent invention.

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<sup>4</sup> i.e., the heliocentric planetary system of Nicolaus Copernicus (1473-1543) in *De revolutionibus orbem coelestium* (*On the Revolutions of the Celestial Spheres*) in Nuremberg in 1543. René Descartes (1596-1650), French philosopher and the most significant modern thinker in RN's pantheon of science.

<p>Animall life</p> <p>Sence.</p> <p>Memory.</p> <p>Judgm<sup>t</sup>.</p> <p>sleep.</p> <p>Dreams.</p> <p>witt.</p> <p>Fear.</p> <p>- of death.</p> <p>vertue &amp; Honor.</p> <p>Anger vain Glory.</p> <p>Governemt.</p> <p>Religion</p> <p>Speech &amp; languages.</p>	<p>Then I undertake the contemplation of animal life in generall, dilating upon the great misery of sence. that it is impossible to consist in matter wholly, but there must be somew't more.</p> <p>Sence brancheth into the knowledg of Memory Judgmen't, sleep. Dream's. <del>Judgm<sup>t</sup></del> /and\ Will. <del>and Reas</del></p> <p>The passion's are a subject too dilated for me to undertake throly, but I shall not omitt some consideration's I have about some of them Especially ffear, &amp; the greatest of all ffear of death, w<sup>ch</sup> corrupts humane nature, and is the cause of Many Evils, and immorality's. I shall also give an Essay upon vertue &amp; honnour, observing how hardly some are susceptible of it, &amp; how Easily other's; y<sup>e</sup> Result of Education, and progeny. The sincerity of Anger, vaine Glory, &amp; some other's of like nature, w<sup>ch</sup> I shall insert in y<sup>e</sup> margin as they occur to my thoughts. and then discour's filosofically upon, policy devine and humane. Religion, &amp; Governement. in these matters that Relate to Men assembled, or together, the grand consideration is the use of Speech w<sup>ch</sup> I shall Enlarg upon, Even historically, wherein I expect as in severall other heads of this devision to thinck my self more impertinent then in y<sup>e</sup> Rest.</p>
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4. part

This shall be onely a Collection of such solutions of naturall phainomena as I thinck obseruable upon the foregoing principles and perhap's some Extravating Essay's may find place there

5. part.

This I intend shall Relate wholly to such art's and sciences, wherein I thinck I have any Thoughts worthy of Remembrance; as Archi=tecture; perspective,

Method Regulated. 1. book.

2. part. 1. Generall's Concerning Motion & Rest

(3) postulate y<sup>e</sup> 2. body's approach.  
 chang necessarily induceth separation  
 objection's  
 Instantaneous.

(1) 2. Termes Expounded.

Impulse {Oblique  
 {Direct  
 Center  
 direction or determination  
 Rotation.  
 velocity  
 force.  
 Reflection  
 Refraction.  
 Chang  
 tendency.

(2) 3. Experiences of Motion, & proposal's for tryalls

4. The law's of Motion.

1. Generall. proved by Reason, & Exp.

Mechanicall

2. 3. Instances of Direct impulses.

Corrollarys.

3. Direction in impulses. {obliq  
 {direct

Reflection

Refraction

5. Continuity & fluidity. with y<sup>e</sup> observation's  
 of Motion's & accidents in [plaido?].



## 1. Of perception.

proved onely  
by it self.

1. That wee doe perceive, must be a postulated truth, and not att all to be proved; becaus it is the first proposition of knowledg. All thing's that are Evident are Either so of themselves, or Els are made so by somewhat Els, w<sup>ch</sup> latter is called proving. as if it were to be proved that in a watch, ten turnes of the ffuzee wheel, gives one turne of the index. the thing not being Evident of it self, you must clear it, by taking the watch in peices, and shewing that by y<sup>e</sup> number of teeth, & cogg's it must be so, w<sup>ch</sup> is a third matter whereby the proposition is proved. But when it is asserted that the whole is equal to all its parts, there needs no proof, (tho it be capable of occular, or practicall demonstration) because the whole and the part's are the same, and included in the same idea, and it is no more then to assert that y<sup>e</sup> same is the same, w<sup>ch</sup> were idle. yet this leads to the proof of some further Consequences, in y<sup>e</sup> doctrine of Quantity; So is our perception a proof to us of many thing's, but of it self, it neither needs proof, becaus it is Evident, nor can it have nay, becaus it is the very first instance of life, or sence, from whence wee move towards the knowledg of other thing's.

Des Cartes hath taken great paines about proving that wee doe exist, and doth it from this, that wee doe perceive, w<sup>ch</sup> is a pretty fetch, and serves to answere scepticks, who are apt to call for demonstration in all things, but the question remains Still, if they will say, prove the inference to be true. therefore wee must Resort to this, that being, & thinking are included in y<sup>e</sup> same Idea, and in the very notion of  
the

the latter, we have the other. and that the truth of our faculty's, or the assertion, w<sup>ch</sup> is Evident to us of it self, must be granted, & cannot be proved, as I observed at first.

Somewhat is perceived.

2. It is a further part of the same thought, that Somewhat is perceived. ffor not to perceive and to perceiv nothing are synonimous/Equipollent\, & the same so that wee perceive, is a proof wee perceiv somewhat

Onely the dif= ferences of thing's are sensible.

3. The next Contemplation is in what manner wee are affected by sence. and herein I must forerun a litle what I have to say upon this subject, giving a summary of it here, & leaving the minuter re= flection's to their proper heads. A positive perception, to begin with the most single instance, must be granted; and that is all, ffor it doth not ffollow, that the perception hath duration. But when another ob= ject comes, that gives a new sence, w<sup>ch</sup> is understood by reason that it is unlike the former, and so of the rest, Every perception being of a different object, as really all thing's in y<sup>e</sup> world doe differ in some point or other, whereby to strike y<sup>e</sup> Sence in various manner's, and are there by distinguisht. So as upon the whole, wee perceiv Nothing but Differences. and Duration of time is nothing but the notice of severall different perception's, and supposing no variety to occur to us, all time is but an instant, & hath neither 'fore nor after, untill a new perception Revives it, and carry's it on in a Seeming Stream, or continual succession of sensation's; w<sup>ch</sup> matter's shall be more [fusely?] handled when I come to Speak of time, & Sence. in y<sup>e</sup> mean time it is Enough to assert that Sence is the notice of variety, and cannot be of more then one thing at one time

That Body by  
y<sup>e</sup> Means of Con=  
tact is the  
subject of Sence.

4. Wee first take notice of our selves, that is, our body's, the shape and proportion of our member's, and what use wee may have of them, and all object's that affect us, doe it by the mediation of some part of o<sup>r</sup> body's, therefore I conclude that Body or Materiall substance, is the thing perceived. and those affect us Either by some intrinsick Quality, or onely by contact. The former is much courted by those that are addicted to chimistry, especially phisitian's. and ffrom severall species of thing's they raise principles, and forge hypotheses, for y<sup>e</sup> solution of naturall question's. such are salt, Sulfur, & flegme. and the paripatetick Eliment's Fire, air, water, & Earth. are of the same consistency, that is altogether p<sup>r</sup>ecarious. there being no knowledg att all, of any such qualities, so that after all, the doubdt will Remaine, what those principles are. and without a foundation they build castles in the air. Therefore in the Excellent method of D. Cartes, to lay aside doubdts as if they are fals, & proceed upon principles y<sup>e</sup> are not disputable, I propose /to\ Reject all those imagination's of materiall Qualities, and suppose perception to be onely of body, and that by the Mean's of Contact. w<sup>ch</sup> seem's very cogent, becaus nothing is more apparent to us then that Body doth not admitt other to come into its place but Reppells another in y<sup>e</sup> point where the substances collide. and other Effect that one body hath upon another I cannot find out, nor Imagine, & therefore suppose there is none. but Contact of body is y<sup>e</sup> cause of sence.

It being p<sup>r</sup>emised that sence comes by contact of some part of o<sup>r</sup> body's, w<sup>ch</sup> is more Evinc't by considering that by obstruct/ing\ any of o<sup>r</sup> organ's, that sence is lost for that time, it ffollow's that the perception is of the variation, or chang of position of the parts of our owne body's. ffor nothing Els is supposed to proceed from Contact, but cession of part's, of w<sup>ch</sup>, more will be say'd in the heads of Body & Motion; And our body's being distributed into severall member's, and some part's of the body of more nice & exquisite sence, that is, Easier moved, such are the Ey, Ear, nostrills, & pallatt, wee have reason to ~~think the object's of sence infinitely variable~~ and the changes of Each of those having somewhat proper, w<sup>ch</sup> creates denomination's from the severall part's affected, wee come to distinguish the severall common organ's of sence accordingly. the infinite number of part's of w<sup>ch</sup> wee are Composed, y<sup>e</sup> least chang of w<sup>ch</sup> makes a perception, may reasonably perswade us that the object's of sence are infinite. But all thing's in the world May be digested into Species, as circles, tryangles, squares &c. in each of w<sup>ch</sup> classe's there may be almost infinite variety, but in None so considerable, as the difference is between, those of one class' & those of another. therefore the severall sensation's wee have from the diffring organ's, & members of y<sup>e</sup> body, Each of w<sup>ch</sup> furnish vast variety, but ~~Each~~ have more similarity in themselves then to any other. as no sight is like nois, nor no nois like tasting, but in seeing, hearing and tasting there is almost infinite variety.

As those variety's w<sup>ch</sup> proceed ffrom the part's of our owne body's, being digested, give the denomination's of the Senses, so object's working on Severall manners, some quick some slow some in great parts, & other's in more minute make other variety's, w<sup>ch</sup> being also digested into classes, make a seeming list of Quality's as if they were inherent in the object's themselves. such are Colour, heat &c. w<sup>ch</sup> in truth are nothing, if you abstract from our manner of perceiving, but the modes wherewith objects strike us. for the body's may be ordered so as to chang those Quality's, or loos them. and they shall to seem to proceed from one when in truth the caus is in another's, such are /is\ the Reflected species from Glasses. w<sup>ch</sup> are irefrangible argument's of this assertion. there= fore are to be considered as nothing. and Body onely Remaines, to be used as a principle, in the deduction of Naturall causes. And in my opinion there is no need of any other, but that will best appear by what follow's.

Body Must be defined, or rather, described by w<sup>ch</sup> wee perceiv of it, w<sup>ch</sup> is that it ffills its place and admitts no other like Substance to come with= in its limits. this is inseparables and, therefore wee ought to Conclude is the very Existence of it. Des Cartes calls it Extension, & D<sup>r</sup> Moor<sup>5</sup> impene= trability, supposing a thing may be extended and yet not impenetrable, tho I think them y<sup>e</sup> same. ffor if you allow one body to penetrate in= to another, all the world may run into one & that into it self, and out of a great deal of matter, litle or nothing be left without any caus but accident; w<sup>ch</sup> is impossible if the rule ex nihil nihil fit,<sup>6</sup> be true, & y<sup>e</sup> works to this p<sup>c</sup> by turning the proposition, non datur annihilatio<sup>7</sup> but, to be more serious, if matter were not im= penetrable, the very nature of Extension were lost, because there would be nothing to circum= scribe it. the Resistance of one body to another & nothing Els determines y<sup>e</sup> Extension, and conse= quently if there were no Resistance there Could be no Extension, therefore I think Extention is Eo Nomine<sup>8</sup> impenetrable.

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<sup>5</sup> Henry More, 1614-87

<sup>6</sup> i.e., 'nothing comes from nothing', an argument attributed to Parmenides, and ubiquitous in Greek and Latin thought.

<sup>7</sup> i.e., 'nothing goes back to nothing' (literally: 'annihilation is not given').

<sup>8</sup> i.e., 'by that name',

2. The next consideration concerning body is Quantity, w<sup>ch</sup> I thinck is compleated in the very Idea of Extension; w<sup>ch</sup> I thus accomodate to be apprehended. a body Resist's another, that is the beginning of the Quantity there. the like ffrom Every region points out y<sup>e</sup> Superficies, & circumscribes the body, of w<sup>ch</sup> you may take some part, for the Resistance, from every Region could not be in y<sup>e</sup> Same point. so that all body w<sup>c</sup>soever hath part's, and is in imagination devisible.

3. The way of Measuring body's or Compu= ting Quantity ought to be Regarded. and, in a word, it is onely Comparison. w<sup>ch</sup> at first disco= ver's in Equality, for a body shall resist other's that come upon it from opposite region's, and one /other body\ shall be contiguous, & not resist those that are adventitious. it follow's that that is less then the other, at least in Extension towards that Reas/gi\on. if any one Quantity be knowne, that is a Comon measure whereby other's are calculated. ffor that taken once twice or thrice gives such other Quantity's accordingly, knowne by that Comon measure.

4. This is the ffoundation of all our Mathe= maticall sciences, w<sup>ch</sup> are onely Method's of Com= paring Quantity's not knowne with Quantity's knowne, and finding y<sup>e</sup> difference. Extension is ex= pres't by a Strait line, & the place of first re= Sistance is called the point; so the like line hath allway's 2. point's where it is supposed, it would resist the impuls of any other body.

The like of a superficies, or flat; in all points of w<sup>ch</sup> it is supposed resistance would be, in w<sup>ch</sup> theory Geometry is conversant, and by a few knowne Quantity's artificially applyed, give's the measure, or Comparison of other's before not knowne and by these, still proceeds farther, to give other's in infallible method, whereby all the famous proposition's of y<sup>e</sup> auncient Mathematician's are at this day, & will for Ever Continue indisputable.

The beginning's of this science are very Single and plaine, Either those they Call axiom's, w<sup>ch</sup> are Evident of themselves, or rather Subsist in the very idea of body, as that the part's and the whole are Equall, viz<sup>c</sup> the same. or 2. that are Equall to one third, are Equal in themselves. viz<sup>c</sup>, are suppost to have y<sup>e</sup> Same Extension. or Els by Construction of the figures, w<sup>ch</sup> gives the Quantities that are wrought with. as that the lines from the center to the circumference, are Equall, because a circle, is made by a line turned upon one of its points. viz. all those are y<sup>e</sup> Same line. the like method is used in other sciences that deal in Solids, or any other sort of Measuring.

Sometimes Quantities are measured, by one stated and knowne Quantity onely, & no other artifice is used. and this is called arithmetick. Wherein an unit is the stated Quantity, or Comon Measure and the argument's or way of working, is onely a mentall Repetition of y<sup>e</sup> unit, or the signification of the name's. as the word four, signifies a Quantity Equall to so many units. wee say two & two makes four. w<sup>ch</sup> is no more, but two + 2. signifieth



The same thing as four, & you have the idea of the unit four times taken all the while in your Mind. As Geometry worketh in Quantities by a comon measure, or some certain measure, so all its proposition's may be also wrought in arithmetick, and those cases where it is discovered no Comon Measure will Serve as for y<sup>e</sup> diagonall of a square, & y<sup>e</sup> Side of it, Number's cannot express; for those are nothing but names ffor the part's of Quantity y<sup>t</sup> Geometry Supposeth. Geometry hath the advantage of an imediate adversion to the thing under Consideration, w<sup>ch</sup> arithmetick hath not, but besides the result of y<sup>e</sup> operation, you must take y<sup>e</sup> paine's to imagine Quantities answering those number's, or y<sup>e</sup> understanding hath but small share in y<sup>e</sup> affair, w<sup>ch</sup> is a double paine. And Arithmetick hath this advantage that when an operation consist's of very numerous part's, that no attention can Comand, the Notation of arithmetick is So Compendious, that you have vast proportion's under y<sup>e</sup> Ey at command. as out of 9. character's and as many places, you have miryads of particular's w<sup>ch</sup> otherwise were above humane Capacity.

Arithmetick hath this advantage also, that the rule is practis't in a few number's, so that y<sup>e</sup> Quantity's are Comprehensible, w<sup>ch</sup> gives a demonstration of the truth of it, and gives way's of proving. and the same rule & proof serves in working great number's, without regard to y<sup>e</sup> quantities signified; & y<sup>e</sup> Rule is y<sup>e</sup> demonstration.

Algebra.

Every superficies w<sup>ch</sup> is supposed to have a Common measure, containeth a certain number of that measure, w<sup>ch</sup> if Square, is called a square number. and so many as fills the side, is called the root, for that side Repeated as often as y<sup>e</sup> same number is, gives the superficies; and always as many times as the unit is contained in the side, the the side or root is contained in the square therefore the side (when you understand it, as it ought to be understood in quantities) is always a mean proportionall, between, the unit and the Square number. Now there Cannot be two Quantities but you May Suppose a mean proportionall. but sometimes number's doe not fit it. as. 1. and. 2. therefore they will say  $\sqrt{2}$ . or the side of two, Supposing that a Square Quantity. w<sup>ch</sup> is no more then to say a mean proportionall Quantity between one & two. these are called surds and the dealing in them is Called Algebra. w<sup>ch</sup> were a most unintelligible Science had they not a concise simbolizing way of noting their Quantities, as in y<sup>e</sup> instance given; and is a method of working a proposition, without Idea's of the subject matter, nothing neerer So pleasant as Geometry w<sup>ch</sup> doth nothing without perfect Ideas of truth, wherein the demonstration & the method of working it, is rather, as y<sup>e</sup> word imports, a shewing of thing's in peices, like Explaining a watch, then proving. ffor it deals [atogether?] in p<sup>r</sup>sent Existent certain Quantity, w<sup>ch</sup> will be farther touched in what follows.

These sciences are justly celebrated, first ffor their absolute clearness & certeinty, w<sup>ch</sup> renders them capable of Demonstration, 2. ffor the admirable use of them in Relation to practice, w<sup>ch</sup> then hath other names as surveying, Gauging &c. w<sup>ch</sup> could scarce be undertaken with any confidence, or Eas, without the demonstrated rules of Geometry, w<sup>ch</sup> doth both abridg the trouble, and assure the practice. and altho there is Error in all manual operation's, and consequently in these, yet that vitiates not the use, because they are small, allowance is made for them and the things themselves doe not Require criticall Exactness. As for the former, Demonstration, I thinck it onely Resides here, because the principle is positive and certein. viz Quantity w<sup>ch</sup> in ye very idea of it admitts more & less, and the imagination determines it. ffor tho a body cannot be Reduc't to an Exact Stated quantity, yet it is capable of all degrees in its nature, and you may suppose it of what demension you pleas. The next step towards demonstration is the settling of axiom's, about w<sup>ch</sup> mathematician's have made some stirr, whether they were, or might be proved, tho they generally have neglected it as vaine, subsisting in this that wee cannot force our natures to doubdt them, and if any one should call for a proof p<sup>r</sup>tending to doubdt, if in publick they would expose him for a litigious fals p<sup>r</sup>tender, if privately, avoid him for a nauseous fool. However I thinck there is an Easy Method of discoursing the certeinty of them, w<sup>ch</sup> is this, that the very supposition Establisheth them; as if there can be a Cubick inch, w<sup>ch</sup> none ever deny'd, then

I say

I say, let A. be a Cubick inch. and shall any one ask me to prove it, when I doe originally suppose it is so? the like, the whole Equall to y<sup>e</sup> parts & contra, as I instanc't before, y<sup>e</sup> is, by supposition the same. so of other's; w<sup>ch</sup> will be yet clearer, if wee consider y<sup>e</sup> signification of words, w<sup>ch</sup> all agree to and imply most of y<sup>e</sup> axioms. w<sup>ch</sup> I prosecute no farther having hinted it before. this is Enough to shew that demonstration is certain in Mathematic's. w<sup>ch</sup> hath Aspers't all other knowledg in the world, because not built upon such certain and determinate principles, and therefore not capable of demonstration; This hath made some profess to despise every thing Els, as not worthy their application. and other's have so puzzled themselves and their matter, with Endeavouring to demonstrate, more mathematico; (as, to instance, zeno of y<sup>e</sup> Muscles,<sup>9</sup>) that their very notion's, w<sup>ch</sup> in plaine solute discour's would be not onely pleasant but usefull have been lost. This is a great Error, as much as to say where is no formal demonstration, there is no knowledg, whereas many thing's are clear enough to us from dayly experience and observation, w<sup>ch</sup> cannot be proved but by discour's relating to observation, w<sup>ch</sup> if you have not made, is not intelligible to you. of this sort, the matter I shall deal in, will consist, wherein I shall not pretend to demonstration w<sup>ch</sup>, if the matter would bear it I should not have y<sup>e</sup> fatigue to compass; but for the reason before hinted, and because, my proposition's Relate to futurity and are not so much of present Existence, it will not. therefore I shall Content myself with declaring the reason of my opinion's as well as I can.

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<sup>9</sup> When he thought about how many muscles were employed by the legs in walking, Zeno fell over. The story of Zeno, number and muscles, plus much else, is perhaps best told in Italo Svevo's *The Conscience of Zeno* (La Conscienza do Zeno), 1923.

5. The last consideration I have of Body, is The figure of it, w<sup>ch</sup> is no other then the Quantity of its parts in certain Imaginary lines drawne ffrom some parts of the superficies, /to y<sup>e</sup> rest\ and those being more or less, determine y<sup>e</sup> proportion of the part's, and give the figure. w<sup>ch</sup> The Artists of whom I have bin discoursing, to Eas their memory's, have digested all sort's of figures into severall denomination's, as circles, triangles, squars prismes cilinders cones &c. and have by certain induction's found out property's in Each sort, that are not at all incident to the rest, these are unknowne y<sup>t</sup> dable in Geometry; therefore I decline particularising.

6. But As to the Judgm't of Quantity, I must observe that as to greatness and litleness, wee make our owne body's, and the power of them the standard. so as to Repute thing's that vastly exceed us, imens & prodigious, with like Epethetes of wonder, and such as by minuteness escape our senses, small & inconsiderable, with like epethets of contempt. whereas Magnitude of it Self hath no Consideration att all, but in Comparison to somewhat Els. And wee have no stated notion of Quantity. ffor while wee are yong, the habitation wee use seem's great, & all other thing's accordingly, w<sup>ch</sup> when wee are men, seem much less, not that they but wee are chang'd. this makes a necessary Resort to a common measure, or a Quantity foreknowne, for judging other Quantity's.

Having, as I thinck, sufficiently observed the nature and our manner of perceiving, & judging of body singly & distinctly taken, I come now to consider w<sup>t</sup> changes & variations it is Capable of, in order to investigate how farr those changes can correspond with all y<sup>e</sup> phainomena of y<sup>e</sup> World.

And ffirst of Single parts, or parts of body that are intire without pore, not being made up of others brought together. these I say separately taken are capable of no chang att all. that is, they cannot be actually broken, or made less, but are adaman= tine and as they were at the dawning of y<sup>e</sup> world So they are at this day & will Remaine for Ever. It cannot be deny'd but Every quantity admitts more & less, y<sup>t</sup> is comparison, therefore Every part of Matter in imagination hath part's, w<sup>ch</sup> may in imagination be separated, but I deny that they can in unporous part's of matter, be actually devided. It is fitt I should give my reason's for this atomisticall opinion, w<sup>ch</sup> are these. if any force will devide a part of matter or break it, it not being determined w<sup>t</sup> force is sufficient, I say. every force will doe it, and then body will be impalpable & there could be nothing hard, Contrary to nature. but you will say a certein force may doe it, tho every force cannot; I answere that by this you introduce a certein imaginary principle in nature of w<sup>ch</sup> wee have no account or Experience, viz<sup>t</sup> that matter is hard to a certein degree. that there is no such principle, wee have this argument, that body is infinitely hard, that is impenetrable.

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<sup>10</sup> The BL curators frequently, but not consistently, cross out RN's numbering on recto pages (whre they put their own f. numbers), presumably to avoid confusion. Where this happens I have shown the number as crossed out, as here.

And since the very Existence of body is hardness or impenetrability, w<sup>t</sup> need is there of supposing it att all frangible contrary to the nature of it? I hope there will be no case to Require that any part of matter should be broken, w<sup>ch</sup> will best appear ffrom the whole sequel.

It is true that wee see the fracture's of Continued body's so frequently, and that, w<sup>t</sup> will not be broke by one force, will be conquered by another, that wee have an idea of breaking from it, and cannot suppose any thing adamantine, the rather because all body's that wee have any sence of are composed of multitude of parts, & those are separable. therefore it may be say'd that if an Engin were made to apply a prodi= gious force to a small quantity, it must break it. but I can deny it as easily as assert y<sup>e</sup> propo= sition of infrangibility, with this further, that such a supposition is vulgar, & derived from dayly observation, w<sup>ch</sup> is not of the thing in Question, therefore not applycable.

Having asserted that a Single part of unporous matter admitts no sort of chang of it self, wee must look into the state of severall body's together, & find w<sup>t</sup> variety those are Capable off

1. It hath bin observed that one single part of matter is unalterable, but hath its figure determined by y<sup>e</sup> Quantity or extension of its parts. in like manner if there are severall part's of matter, those alltogether constitute a figure, by the extent of them & their part's, w<sup>ch</sup> is as positive and determinate as the figure of a single body. But with this difference onely, that the figure of a single part is unalterable, but that of constituted of many parts, is changeable, as the part's are farther or neerer, to Each other, or otherway's scituated. so that while this ffigure is changing, wee say there is motion, while they doe not chang att all, wee say they are at Rest; and in a word Motion is nothing but the chang of position of materiall part's with Respect to each other. and ffor facility of apprehension, I shall Seldome instance in More then two body's, moving, and the rest of the world as a third Resting. or Els take o<sup>r</sup>selves for a third, & waive all other's, w<sup>ch</sup> is y<sup>e</sup> Same thing.

2. This being all that can be made of motion I must in the next place pare away, the ordinary p<sup>r</sup>judices w<sup>ch</sup> are likely to disturd/be\ this hypothesis.

As first that altho wee use the abstracted words of motion & Rest, as if they were beings really Existing, wee mean nothing more then is hinted before, ffor the body's moved are still the same, neither increast deminish't, nor anyway altered by it. it is usually suggested, to argue the Contrary,



Note.  
 Quality impres't  
 a chimera.  
 Motion imparted  
 or transmitted ano=  
 ther.

That a body put into motion hath had some=  
 what happen to it w<sup>ch</sup> it had not before; true,  
 the figurable position it had with all y<sup>e</sup> adjacent  
 body's, is changed, but nothing Els, and if you  
 can suppose all the body's of the world anni=  
 hilated but one, you take away the distincti=  
 on of motion and Rest, the same being nothing  
 but comparison of place /or, distance, w<sup>ch</sup> is y<sup>e</sup> Same thing.  
 \

2. That the motion is indifferent to the severall  
 body's Concerned, as for Example A. & B. you  
 cannot Say y<sup>t</sup> one or y<sup>e</sup> other moves, or Rests, but  
 onely that they approach, or separate; unless you  
 Regard other body's and then, that w<sup>ch</sup> changeth  
 its position with those least, is say'd to move  
 least, and if not att all, then to Rest. and all  
 the Effect's in nature are accordingly, for it is  
 no matter whether a ship is driven thro y<sup>e</sup>  
 water, or lying at Anchor, the stream Comes a=  
 gainst that, the rudder hath the same influence  
 and the phenomenon of y<sup>e</sup> water passing is the  
 same.

3. The Judgmt is from the greatest, and when the  
 chang is onely the removal of a small part,  
 and all the rest keep, their station as to each other  
 the one is say'd to move, and the others Rest,  
 altho, the caus of y<sup>e</sup> chang was in them. the  
 phaenomena of the heaven's moving, is a preg=  
 nant instance of this. ffor to us the sun & pla=  
 net's seem small, because they are farr remote  
 but the Earth wee live upon, and the body's  
 upon it, great, becaus neer. the alteration of  
 the day, is no more than this. that in the mor=

ning the sun is on one side of the meridian and on the other at night, w<sup>ch</sup> is but y<sup>e</sup> chang of scituation. and appear's as well, if y<sup>e</sup> earth be removed as if the sun were removed, but /vulgarly\ wee hold /it is thought\ the sun Moves, becaus that is least considerable to our Ey, and but one single thing, whereas the houses, trees, Churches, & other terres= triall body's, keep their station, /mutually\ & to us are great & heavy therefore wee judg those rest, w<sup>ch</sup> is Still Gospel to those that are not acquainted with astronomically demonstration; y<sup>t</sup> y<sup>e</sup> Sun Stands still in Respect to y<sup>e</sup> fixt starr's, & y<sup>e</sup> Earth Moves. here is our observation bounded, but if wee Could fly beyond this world and see many more and other object's, perhaps wee might ffind y<sup>e</sup> Sun & all his attendant's upon y<sup>e</sup> march, or at least w<sup>ch</sup> is all one, changing his position with those other body's. So fallacious are our judgm'<sup>ts</sup> of motion.

It is usuall for those that discour's upon motion to dilate much of mixt motion's, and body's having severall motion's at y<sup>e</sup> same time Severall way's. w<sup>ch</sup> the aristotelians some have held im= possible, and used to be a great argument ag<sup>t</sup> the Epicicles, w<sup>th</sup> w<sup>ch</sup> they solved the retrogra= dation's of the planet's. for it was say'd one body could not go round one way, & be carryed round another. this was confuted by the brass spheres y<sup>t</sup> use to be made to illustrate the pto= lemaick systeme of the ~~spheres~~ heavens. all w<sup>ch</sup> consideration's will clear up, by taking motion upon this principle, to be nothing of it self, but onely with respect to other body's

ffor as a body may seem to move, because the position of those y<sup>t</sup> are neer, chang not otherwise then in Respect to that. So likewise that, and the rest altogether, may chang position still with other's, and them still with other's, ad infinitum, Every of w<sup>ch</sup> removes seem's to give the first body another motion, as if that partook of all; whereas there is not any more motion or Rest to be assigned here or there, and the motion is onely as the minority Represent's it to be, and all that can be say'd substantial & true in the Case, is thatt altogether there is a chang of position after severall manners, of w<sup>ch</sup> wee have certein Opinions, that some or other's move accordingly as the majority or minority is. And it is impossible to describe the line a body Moves in, without Regard to some stated body, & then it is onely the measure of space y<sup>t</sup> doth it, but if those body's move also, you are at a loss again.

Therefore it is to be no more a difficulty that a body in such Respect's as I have hinted. is Susceptable of infinite severall motion's, as the multifarious part's of matter may chang position & distances infinite way's, ffor no Sort of /y<sup>t</sup>\ change is to be Excluded or thought impossible, but where Extension, or body meet's with the like, and then the nature of it Makes an interruption. I should now proceed to more particular Reflection's upon the reason & rules of motion, but I must first consider the nature & Reason of time as part of this generall theory.

Time<sup>11</sup> & Motion are one & y<sup>e</sup> Same observ=ation, but to a different porpos. ffor in motion wee onely observe y<sup>e</sup> chang of the position of body's, but y<sup>e</sup> Notion of time is the observation or Comparison of Severall changes together. as when wee say, that w<sup>ch</sup> was here, is now there wee mean onely, it is moved; but when wee say that, of 2. body's. this was here & moved thither, & is here againe, and y<sup>e</sup> other was here with y<sup>e</sup> ~~ether~~ first, & moved w<sup>ch</sup> it but is now but there; wee mean y<sup>e</sup> first Moved as swift againe, as y<sup>e</sup> second. or hath double y<sup>e</sup> velocity of it. This is Judged by stated termes, as y<sup>t</sup>, a quo, &, ad Quem.<sup>12</sup> and y<sup>e</sup> Sence we have in Either, and y<sup>e</sup> body in y<sup>e</sup> first terme is one Idea, in y<sup>e</sup> second another. both different sensation's, and y<sup>t</sup> difference is y<sup>e</sup> Caus they are perceivable, as I noted towards y<sup>e</sup> beginning. It follow's that time Consists intirely in y<sup>e</sup> Succes= sion of these variety's. and if it Could be y<sup>t</sup> no variety Should happen to one man for a cer= tein space, he would be no more sensible of y<sup>t</sup> time then one y<sup>t</sup> hath slept, ffor y<sup>e</sup> chang of day's hours, &c. w<sup>ch</sup> really are time it Self are absent, and y<sup>e</sup> next new object were to him an imediate continuance of time. & the space interposed as sence less blank in his nature;

<flourish u.l.>

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<sup>11</sup> The text (not the header) is in a different pen (which has been used in some of the preceding corrections). This indicates a pause before the continuing of the essay.

<sup>12</sup> i.e., 'from which' and 'to which'.

27. Time.  
<flourish u.l.>

The ffirst use of time is y<sup>e</sup> Comparison of swiftness, of w<sup>ch</sup> wee make o<sup>r</sup> owne power y<sup>e</sup> Standard, as I observ<sup>d</sup> before about Magnitude. ffor that w<sup>ch</sup> outrun's us is Swift, & y<sup>t</sup> w<sup>ch</sup> wee Easily outgoe is Slow, generally Speaking, but in other thing's more particular, y<sup>e</sup> Compa= rison is by y<sup>e</sup> Same methods, as Quantity. viz<sup>t</sup> some stated Comon Measure. as an hour, w<sup>ch</sup> is y<sup>e</sup> 24. p<sup>t</sup> of a day. &c. or Some other Com= munis Mensura,<sup>13</sup> as y<sup>e</sup> motion of a pendulum, & applying that in Number's to w<sup>t</sup> is sought. as when one pendulum vibrates once while another vibrates ten times, So y<sup>t</sup> y<sup>e</sup> buisness of time Comes under y<sup>e</sup> y<sup>e</sup> Cognisance to ma= Maticall men, by vertue of its Comunis men= sura, as unit, & Stated Quantity in other branches of y<sup>t</sup> Science. and all founded upon y<sup>e</sup> principle lay'd downe, y<sup>t</sup> time, & motion are y<sup>e</sup> same, & Motion onely the variated aspects of severall body's, & neither any thing if Body be taken away.

Wee are more Sensible of time, then wee should be, if wee had not such vast occasion to take notice of y<sup>e</sup> Measure of it. ffor all meeting's of men, intelligence, history, & buisness depends upon y<sup>e</sup> use of this art. & consequently is become universall, & practis't Even by infants like y<sup>e</sup> art of Speech. and All mankind agree in y<sup>e</sup> Same Com= mon Measures; vis<sup>c</sup>. y<sup>e</sup> sun's Returne to y<sup>e</sup>

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<sup>13</sup> i.e., 'common, or shared, measurement'

Time.

Same place in y<sup>e</sup> heaven's, w<sup>ch</sup> is a year and, then his Returne to y<sup>e</sup> Meridian, w<sup>ch</sup> is a day, w<sup>ch</sup> is subdevided into 24. hours, 60 minutes. &c. wherein it is observable; when y<sup>e</sup> Motion's are so swift, y<sup>t</sup> wee can move some part of o<sup>r</sup> body's Equall to it, wee can continue y<sup>e</sup> measure tollerably well, as in [keepink?] time in musick, w<sup>ch</sup> is done by synchronous pulses of y<sup>e</sup> hand. And wee can comand Such a motion tollerably well by y<sup>e</sup> memory of past Strokes whereby we judg of y<sup>e</sup> rest. But when y<sup>e</sup> Motion is so swift that wee cannot command any part of our body to move so Swift wee loos y<sup>e</sup> distinction of y<sup>e</sup> pulses. and it seem's a continuation, & not succession. such is a tone in musick, y<sup>t</sup> is synchronous pulses of a vibrating string, but so swift as wee cannot distinguish them. and such are y<sup>e</sup> Continuall Sensation's y<sup>t</sup> make us thinck y<sup>t</sup> time is a Continued stream, whereas it is not such. but onely a succession of varied perception's, but so Swift y<sup>c</sup> wee are not Capable to discerne y<sup>e</sup> periods or distinguish them. On y<sup>e</sup> other Side if the periods are so long that no motion of our body's (for these are our Standard alway's) can conforme to them, such are day's year's & hour's. wee cannot conceiv them att all without resort to y<sup>e</sup> Mark vis<sup>t</sup> y<sup>e</sup> body's /Sunns\ returne to a certein place. and this hath occasioned y<sup>e</sup> invention of clock's, w<sup>ch</sup> are disposed to subdivide y<sup>e</sup> greatest periods.

This Method of understanding time, hath led me to very pleasant Contemplation's, & perhaps not unprofitable, in Relation to y<sup>e</sup> most unsoluble Question's of theology. If you can once be brought to lay aside, y<sup>e</sup> distinction of ffore & after, with body; y<sup>e</sup> divine nunc stans<sup>14</sup> must take place. and that answers y<sup>e</sup> comon objection to y<sup>e</sup> ffree will wee know wee have, from y<sup>e</sup> divine p<sup>r</sup>science, supposing w<sup>t</sup> is foreknowne is not contingent but must happen. ffor y<sup>c</sup> w<sup>ch</sup> to us seem's future to y<sup>e</sup> Deity is p<sup>r</sup>sent, & so y<sup>t</sup> w<sup>ch</sup> is past is p<sup>r</sup>sent; y<sup>t</sup> is, time follow's us imperfect creatures onely, whose know=ledg is onely of body, & its c/h\anges. and therefore can scarce abstract so farr to imagine a possibility that there should be a State not sensible of time; for how can we ima=gine a thing forrein to our nature. nill in intellectu quod non prius in Sensu.<sup>15</sup> but a perfect being y<sup>t</sup> cannot Chang, with infinite knowledg, is not sensible of time, nor doth know ffrom that mode as wee doe, (altho it must be allow<sup>d</sup>, y<sup>t</sup> infinite knowledg is not without notice of our Condition & mode of sence) but hath all knowledg p<sup>r</sup>sent, to Con=clude, I must desire out thincking freinds<sup>16</sup> to bring themselves off from this most prejudicated opinion, that time will Remaine when body is gone. Els I hope for litle advance in truth by their assistance

<flourish u.l.>

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<sup>14</sup> i.e., 'abiding/prevaling now', the timeless state of eternity, time standing still.

<sup>15</sup> i.e., 'nothing in the mind not previously in the senses', the 'Peripatetic Axiom' (i.e. adopted from Aristotelian philosophy) and closely identified with the epistemology of St Thomas Aquinas and his followers (more correctly: 'Nihil est in intellectu quod non prius in sensu', *Quaestiones disputatae de veritate*, q. 2 a. 3 arg. 19).

<sup>16</sup> i.e., Newton and his followers who argued that time was absolute.

Farfax

How vaine are our fancies about time; for when wee are pleased wee say y<sup>e</sup> time passeth Swift, and when in paine dully, and can scarce beleev y<sup>e</sup> clock's themselves, w<sup>ch</sup> shew's wee have No dependance upon it, nor is y<sup>e</sup> notion of time in o<sup>r</sup> natures, but onely as y<sup>e</sup> accidents of our body's suggests to o<sup>r</sup> minds. therefore it is no unreasonable opinion of a fantastical author in his bulk & selvedge of y<sup>e</sup> world<sup>17</sup> that, as time with men who live in paine, is more or less according as their paine is, so with y<sup>e</sup> deity y<sup>t</sup> is free from paine it is nothing att all.

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<sup>17</sup> Nathaniel Fairfax (1637-1690), *A Treatise of the Bulk and Selvedge of the World; Wherein the Greatness, Littleness, and Lastingness of Bodies are Freely Handled*, etc, London, 1674. One feature of this book, to which RN refers to elsewhere, is Fairfax's refusal to use Greek and Latin derived words. Fairfax and RN were on opposite sides of every political and theological debate, but RN is always respectful of him and mentions this work at several points in the MSS.



There are some other notion's dependant upon body w<sup>ch</sup> have occasioned much argument, & can never be cleared, becaus above y<sup>e</sup> reach of o<sup>r</sup> Capacity's, w<sup>ch</sup> I Mean not to dwell upon, but Shortly hint my reasons y<sup>t</sup> determine me to one or other opinion.

First as to Infinity of Matter. that it hath no bounds either in extent. or minuteness. ffor wee have no light to incline us to beleev y<sup>e</sup> world is confined. if wee had onely y<sup>e</sup> Sun & planet's to observe as if our optick faculty could not catch such glimerings as y<sup>e</sup> fixt starr's are to us, wee might More reasonably beleev, there were no More great luminary's in y<sup>e</sup> univers, and perhaps that y<sup>e</sup> world were confined to the Sphere of them. but wee find vastly y<sup>e</sup> Contrary in y<sup>e</sup> distance of y<sup>e</sup> fixt starrs. and as that exceeds o<sup>r</sup> imagination so Much. so may wee conclude in prosecution of farther distances, without any Reason to limit us, w<sup>ch</sup> is y<sup>t</sup> wee mean by Infinite.

Eternity of time differs from infinity of Space No otherwise then, as time differ's ffrom Motion, observed Even now. ffor it follow's Motion, or chang of position, and is by y<sup>e</sup> comparison of severall changes, and till a totall annihilation of body or absolute acquiescence of all y<sup>e</sup> parts off it time will be. The like Reasoning will take place in subdeviding time, as of body, or Motion, w<sup>ch</sup> is measured by body, & therefore all one, and without Bounds toward minuteness.

The next consideration of infinity is that of Minuteness; Wherein men have differed with great pertinacity, p<sup>r</sup>tending to demonstration on both Sides. Some holding there are, others that there are No minima, or indivisible parts of Matter. If it be ment that there are part's not actually devisible, it is y<sup>e</sup> opinion I have before set downe in My discourse of body; but if it be intended that such parts are notionally indevisible, y<sup>e</sup> atomists are in y<sup>e</sup> wrong, for so long as it is body it is Extended, w<sup>ch</sup> in y<sup>e</sup> very Idea of it includes comparative Quantity. My opinion is a kind of Mean betwixt y<sup>e</sup> two extream's, Namely that unporous part's of body cannot be devided actually by any force; w<sup>ch</sup> Consists with y<sup>e</sup> atomist philosophy; and next that there are parts small actually as infinitum, w<sup>ch</sup> Consists with those y<sup>t</sup> Say there is no Minimum on Nature. My Reason is y<sup>e</sup> Same as ffor infinite Extent, v<sup>ist</sup> no reason observation or Experience to incline us to limit thing's. but on y<sup>e</sup> Contrary y<sup>e</sup> more artifices wee have to discover y<sup>e</sup> minuter body's wee find y<sup>e</sup> Same indication's of farther minuteness. as for instances in litle animals, y<sup>t</sup> Escape our /bare\ sight, by y<sup>e</sup> help of Glasses, are discerned & so small, that a sand Equalls a million of y<sup>m</sup> yet those Creatures are organised no less curiously then y<sup>e</sup> Greatest, and as such live upon greater, so less May, for ought wee know live upon them.<sup>18</sup>

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<sup>18</sup> Robert Hooke (1635-1703), *Micrographia: or, Some physiological descriptions of minute bodies made by magnifying glasses*, London, J. Martyn and J. Allestry, 1665, had astonished Europe, popularising the discoveries of microscopists; Anthonie Van Leeuwenhoek (1632-1723), the celebrated Dutch microscopist in Leiden, continued to publish his papers through the Royal Society up to his death.

Therefore wee reason ag<sup>t</sup> the cours of Experience if wee conclude any terme's of litleness, but rather wee are oblidge to assent to this proposition, That matter hath part's infinitely Small so y<sup>t</sup> no space can happen but there will be Body's at hand ready to ffill it.

This letts me in to y<sup>e</sup> next Consideration, w<sup>ch</sup> is of vacuity. a Chimeara admitted by most vertuosi, to supply a seeming obstruction to motion, w<sup>ch</sup> is answered in y<sup>e</sup> fore hinted proposition ffor they say that without a vacuity there Can be no motion, becaus Spaces will be angular y<sup>t</sup> is infinitely small. y<sup>e</sup> application of y<sup>e</sup> answer is obvious, so I prettermitt it, And shew according to their principle, there will be y<sup>e</sup> Same obstruction to Motion. ffor by y<sup>e</sup> Giration of y<sup>e</sup> air about y<sup>e</sup> Sun, w<sup>ch</sup> they admitt, all parts of it Receed from y<sup>e</sup> Center, & croud outwards and if y<sup>e</sup> world be not full, y<sup>e</sup> vacuity must be in y<sup>e</sup> Sun, and that crouding is a force too great for y<sup>e</sup> motion of a Small part to hinder or conquer. ffor if a part moving must Make its owne room, it must Remove all y<sup>e</sup> matter between it self, & y<sup>e</sup> Sun. Els must be contented to ly Still. ffor y<sup>e</sup> parts are Crowded to a perpetuall Contiguity. but if you will allow this actuall infinity, there is no impedim<sup>t</sup> to Motion, but y<sup>e</sup> parts chang & entermix, w<sup>ch</sup> but

clashing ag<sup>t</sup> y<sup>e</sup> universall pressure, as body's Equilibrated in water are easy to move becaus y<sup>e</sup> weight of y<sup>e</sup> water is no impedim'<sup>t</sup>.

For this Reason, that there is no necessity of a vacuity, I Reject it. and no one can admitt it without a perswasion y<sup>e</sup> world Can= not subsist without it. ffor it is a sort of fflaw or defect in Nature, y<sup>t</sup> wee have no Experience of, nor Can imagine otherwise then by y<sup>e</sup> idea of a vessell, y<sup>t</sup> conteins onely air. and as it is difficult to abstract y<sup>e</sup> notion time, becaus wee never lived a minute, w<sup>ch</sup>= out y<sup>e</sup> Sence of it. So it is hard to abstract out of us y<sup>e</sup> notion of a vacuity, because wee see Every day y<sup>t</sup> w<sup>ch</sup> wee call Emptyness tho wee know it is not such. Whereas in nei= ther ought wee to Conclude ~~one or the other~~ upon y<sup>t</sup> p<sup>r</sup>judice, as iff nature were such as wee are misguided to Fancy.

There are some who fancy a Resilition or  
springyness in all body's, w<sup>ch</sup> make's them bound  
and Reflect upon all clashing's & Collision's  
w<sup>ch</sup> I cannot assent to, ffinding it inconsistent  
with y<sup>e</sup> nature of body, w<sup>ch</sup> is infinite or perfect  
hardness, and Every spring supposeth a yeilding  
and a force to Result. besides there is no need  
att all of such a principle in y<sup>e</sup> method I  
proceed by ffor solving the cases of motion, of  
w<sup>ch</sup> Reflection is part.

The world is knowne to us, onely by y<sup>e</sup> Means of our sences, according as they are wrought upon by Externall thing's, ~~that are~~ called the objects of them. Here are two Considerations, 1. what these objects seem, 2. What they are in themselves. ffor It doth not at all follow, that objects are really those things wee perceiv, becaus wee perceiv them so. ffor many thing's Interposing between us and them may alter the mean's of Impressing our Sence, and vary the Image from y<sup>e</sup> object; and wee Manifestly know it is so. by Glasses, Reflexion's & y<sup>e</sup> like. Wee must Conclude. 1. that the very Image ~~that~~ our mind contemplates, is really formed in our body's, from whence y<sup>e</sup> mind hath it. So there is No doubdt, but when wee thinck we perceiv any thing, there is that thing in us, w<sup>ch</sup> gives us that perception; be it a fancy, or dream, or w<sup>ch</sup> is most comon to all, memory, wee may be Sure that In our body's that action or disposition w<sup>ch</sup> Impresseth that Image is true. but wee cannot carry that one to objects, without us. as to argue becaus I thinck such thing's are without me, therefore In truth there are such. therefore wee are to Conclude that our sences /are true\ that is the Images w<sup>ch</sup> the organ's p<sup>r</sup>sent are truly Such as they appear to be, but our judgm<sup>ts</sup> or Conclusions from them  
may

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<sup>19</sup> From here on (up to 90r), in pencil, an earlier BM numbering has been crossed out. RN's own alphabetic numbering is also crossed out on the recto pages. The paper employed in the next section (to f. 24v) is much more porous making legibility a problem where ink has soaked through.

may be, and are, for the most part fals. But yet there are Methods of Regulating this defect of judgm<sup>t</sup>, whereby areasonable assurance is had, If not of all, yet as many thing's, cheifly such as are Gross, & apparent; but of such as are Not apparent so as to be subject to ~~such~~ /the\ methods of / nice\ Ex= amination, wee have but fainter proof's, onely such as are probable, or In plainer English Guessing, but of that there is degrees of more or less, and Some thing's shall happen to be more neerly discovered then others, and that In a manner so perswading, as a denyer must be despised rather then Argued with.

This faculty ~~or Method~~ of Comparing object's with their Ideas, is the same wee call Experience. and is Not so much referred to a filosoficall Nicety, as to the perpetuall ~~series~~ /cours\ of life, ffor there is not a Moment we breath, but there is some Sort of Experience advancing, even sleep it Self, furnisheth matter of consideration, and Many have made discovery's In dream, w<sup>ch</sup> waking were Remembred, & proved very Considerable. Experience consist's In memory & Reflexion or attention. ffor by comparing the memory of an object seen at hand, with the p<sup>r</sup>sent sence of it at distance, the difference is noted. thence It is argued

that this object, or its like, appearing as It did at distance, is really distant, & Not at hand, unless it appear's as it did when it was so Near So also for Consequences, If one thing /hath\ followed another, when wee see y<sup>e</sup> former againe, we Expect the other to succeed; and If often so, wee begin to depend it will, and If Never failing conclude with greatest confidence, it will /must\ be so. This is the argument wee have ffor the Sunes rising, and all y<sup>e</sup> mundane periods, w<sup>ch</sup> Shew's that In Events Constantcy, is almost a Sure prognostick, tho it grows out of ~~of~~ an Indifferent root. as one Instance is litle, many considerable, and multitudes without Interruption, almost certein. It is but thus and No otherwise that wee determine the Events of heat, cold, weight &c., and how it branches out In our practiq to Informe us, as most are ordinarily, as to y<sup>e</sup> uses of life, and many filosofically ffor discovery's I need not Inlarg, but leav to Imagination, w<sup>ch</sup> will declare more of it, then I Can Express.

The first thing wee learne is our want's and Means of Supply, & then y<sup>e</sup> use of our Members, as children will admire their hands & feet & their motions, w<sup>ch</sup> are the first Experiments they try. they, as their senior's also, doe admire Eclattant objects, as light & sounds, but consider litle of them, onely consequences, from frequency, is argued Naturally from them.



As beating, from Chiding; good thing's, from fair words, & y<sup>e</sup> like. w<sup>ch</sup> are y<sup>e</sup> beginnings of Experience, and when, with age are matured, ~~Make the~~ produce Science, distinguish't as y<sup>e</sup> object's are, & wee Call it, prudence, policy, morality a philosophy, w<sup>ch</sup> are but Subdivision's of Experience. the latter deals in Essences, &c. /the\ Event's of Naturall things such as our discours aimes to Explain.

I shall Now pass over the generality's of the Mundane System, and take the whole upon y<sup>e</sup> foot as, Since Copernicus, and Cartesius the vertuosi most in Esteem, place it. I mean the corpuscular hypotheis, and the Earth's & planets Motion, &c. these were Noble argument's /Subjects\ while philosophy, like an Insect Metamorfosing was an aurelia, and Enterteined y<sup>e</sup> world, but now y<sup>e</sup> Caus is tryed & determined, Except where ambition and power patronise Ignorance, for corrupt Ends. And as often happen's, when a dispute is wrought bear bare, or worne out, Some Ingenious Sumis't<sup>20</sup> takes up y<sup>e</sup> Subject, and sends it a broad /the Resolution\ well drest & contracted; so hath Mons<sup>r</sup> Hugens done, In his peice, posthumously published;<sup>21</sup> ffor the mundane systeme is so clearly unfolded there, that who hath a mind to learne or be confirmed, need goe No further.

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<sup>20</sup> i.e., Summist (summariser)

<sup>21</sup> Christiaan Huyghens (1629-95), RN is likely refering to his *Cosmotheoros*, published in 1698.

There may be many hypotheses or Inventions  
 ffor solving the planets courses, as the polo=  
 maick of old, by solid sphear's & epicules,  
 and the last, by reciprocall attraction, centri=  
 petall & centrifugall forces.<sup>22</sup> It is strang what  
 a priveledg dogmatizing arrogates In matters  
 not subject to Immediate Experim't, as In this  
 Instance of ye heaven's. What is it to me, whethr  
 the Hypothesis fibbs or not, while Neither by  
 direct Nor analogicall Experience, It is  
 manifestly proved true. As neither of those  
 are Nor any other, but the Copernican, un=  
 folded more plausibly by Cartesius. And here  
 I would not be understood, to patronise the  
 minute contrivances of Cartesius first & second  
 Element, &c<sup>a</sup>. but goe with him thus far &  
 no farther, that is that ye world is ffull of  
 fluid matter Ever in motion, and that Not  
 onely by Intestine agitations, but generally flow=  
 ing In vast whirlpools about centers, w<sup>ch</sup>  
 are called sun's & starrs; And Shewing a  
 consequence of these girations to be a  
 generall recess from the center of the Mo=  
 vement, w<sup>ch</sup> by ye laws of motion is stronger  
 in some then In other body's. the weaker  
 give

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<sup>22</sup> Claudius Ptolemy (c.90-c.170); the principal cosmological work attributed to Ptolemy is known as the *Almagest* (its Arabic title), it is the only surviving ancient treatise on astronomy. It is presented as a summary of the wisdom of the ancients, as well as as the result of Ptolemy's own observations. Ptolemy's model is geocentric and employs the notion of concentric spheres to explain the appearance of the sky from Earth. The 'reciprocall attraction' hypothesis is that of Newton and his followers.

way to the stronger, & are by that mean's Crowded towards y<sup>e</sup> center, and from thence to the circumference there resides matter of different degrees In power to Recede, according to distance /where\ there is a sort of ballance of it; for If taken farther from y<sup>e</sup> center, it is among Stronger, & there it Must give way, & come neerer, w<sup>ch</sup> is called Gravity. If taken neerer, it shall Recede till It come Into equality, & this is accounted levity,<sup>23</sup> w<sup>ch</sup> are consequent of Each other, but whatever the spightfull vertuosi have Sayd to y<sup>e</sup> contrary, levity is y<sup>e</sup> positive, & Gravity but the consequent. Then that the planets are aggregates of matter Conglomerated, of such parts as all-together are of Equall force of Recess as the generall matter of y<sup>e</sup> vortex is In that distance where they reside and so are ballanc't, as being neither light nor heavy there. And so for y<sup>e</sup> Subvortexes, and secondary planetts, as y<sup>e</sup> moon, [~~statal~~] /&\ satellit's of Jupiter & Saturne, w<sup>ch</sup> attend in y<sup>e</sup> vortexes of their Master planet's, as they in that of their Sun. and so without any thing of convulsion violence or attraction, but as a logg in a Stream, are made move by y<sup>e</sup> fluid In w<sup>ch</sup> they are ballanc't

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<sup>23</sup> Note that 'levity' is presented as a counter force to 'gravity'.

Ballanc't, & Swim, with velocity Equall  
 or very near the same, as it hath In that dis=  
 tance. And this keeps them all In their places, so  
 wonderfully as they seem to doe, but really consi=  
 dering the comon cours of things wee live amongst  
 So farr from wonder, as to be Most familiar and  
 ordinary. ffor Is Not y<sup>e</sup> Sea ffull of Currents and  
 vortexes, so the air, and all considerable fluids  
 wee know. why then should the Grand Fluid of  
 y<sup>e</sup> world stand still, and If it moves, what won=  
 der is it that lumps of matter swimming as  
 hulls of Shipps, ffeathers, &c, doe In water or  
 air, goe along with it. The hull of a Ship is  
 ballanc't by its weight so much in & so much  
 above y<sup>e</sup> water, after y<sup>e</sup> laws *Insidentibus*  
*humido*.<sup>24</sup> Why should wee look for other powers  
 to ballance y<sup>e</sup> planet's In their places, then  
 their weight, with Respect to y<sup>e</sup> Center of their  
 Motion. And that Comet's, are Either Growing  
 or wasting planet's, come into our vortex  
 with a *vis Impressa*,<sup>25</sup> that is Not Easily Stopt,  
 tho perhaps In place not ballancing, but  
 ag<sup>t</sup> the power of Gravity or levity, yet a while  
 persevering, and then Either by those forces  
 Recovering

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<sup>24</sup> Archimedes (c.287–c.212 BCE) *De Insidentibus Humido* (known as *On Floating Bodies*). The works of Archimedes have a long history, but RN would most likely have come across *De Insidentibus Humido*, in full, in English, in Thomas Salusbury, *Mathematical collections and Translations*, 1661, London, William Leybourn. There is little doubt that Salusbury's volumes shaped RN's knowledge of then current scientific theory. They are extremely important texts, not only for being translations into to English, but also for having set out a canon of texts of the New Philosophy. Copies are now extremely rare.

<sup>25</sup> i.e., 'original or immediate force', a term used not only in mechanics/science, but in law, too.

Recovering, ag<sup>t</sup> y<sup>e</sup> vis Impressa w<sup>ch</sup> Spends as a  
 bouling, or the body of the Comet was=  
 ting, or both, a new force, after y<sup>e</sup> laws of  
 projectiles or as a bomb out of a Mortar  
 In the air, by parabolick or Elliptick figures  
 or neer them, is given to it, & then away it  
 Goes with great swiftnes, & perhaps plays y<sup>e</sup>  
 Same Game in another vortex. And till it  
 ceaseth to wast & consume, cannot be a pla=  
 net, becaus it holds Not the Same Gravity, but  
 Grows lighter, or perhaps heavier by accession  
 conversion or assimilation of Matter w<sup>ch</sup> Chimists  
 often prove is done by fire, and perhaps it  
 may Either wast Quite away, or Coalesce with  
 some Starr, y<sup>t</sup> is Not visible, and as New fuell  
 ascend a greater fire, whereby it may be=  
 come Eminently visible to us as a Starr,  
 such as more then once have bin observed New  
 In y<sup>e</sup> heaven's, and to wast & vanish, as wee  
 may conceiv it possible that accension wasts.  
 I doe not argue these thing;s here, nor heap up  
 the demonstration's that have been made by  
 the most dilligent Improvers of knowledg the  
 Astronomers; but have touch't the generalitys  
 of y<sup>e</sup> heaven's that is of y<sup>e</sup> world, in a way of

Collating them with ordinary passages here, whereby I thinck it Impossible that any one Can understand, & Not beleev, all are of a kind, & /that\ y<sup>e</sup> Same analogy of thing's runns thro y<sup>e</sup> whole world. I know y<sup>e</sup> astronomers are very positive in their Calculates, & Ever p<sup>r</sup>tend to correct one and other, the latter those that went afore, w<sup>ch</sup> correction's they prove by the Error's they discover In their p<sup>r</sup>decessor's tables, & So Make New ffor their Successor's to Correct, ffor atho their prognostick's of Ecclipseses, & appulses, &c come neer, yet they never jump with any of them. 1/4 hour Error is ~~Nothing with them~~, /ordinary\ w<sup>ch</sup> is. 1/96<sup>th</sup>

part of a Revolution, and there are anomalie's of w<sup>ch</sup> they can give No Manner of account. It may well be supposed that their Subtile Instrument's In practise may at such vast distance spread the litle Error's (for what practise is perfect?) Into Immense Space. But I rather thinck that y<sup>e</sup> Courses of y<sup>e</sup> planets, from various accidents In y<sup>e</sup> world unaccountable to us Rep= tiles, vary deviate from all rule, and are In truth wholly anomalous, onely In y<sup>e</sup> Main y<sup>e</sup> Cours May be for y<sup>e</sup> Most part Nearer\ly in\ Some Regular path w<sup>ch</sup> were anciently Supposed Circles, Now Ellipses. so that No two day's, years, Nor century Ever  
were

were or will be Equall. Nor was y<sup>e</sup> path of a planet (If there could be a gage) the same, or the figure of its cours like, In any two Revolution's, & so of Every alteration's In that Grand System of our world. To this they say there are Inequality's but so small, that they are Inconsiderable. I desire to know, what <sup>11111</sup>.<sup>26</sup> is at y<sup>e</sup> distance of saturne? So Much that the diameter of y<sup>e</sup> Earth is a trifle to it. doe they Not differ above 1/4. In the Calculates of the sunns' distance? So More or less In Every thing; they are continually Refining to ad=just Instruments, w<sup>ch</sup> serve to adjust that No exactness In Instruments is a Match for the occasion. Nor doe Nature, & Instrument's agree. these are made with rule & compas Guided by a de=signing hand; those Exposed to all accident's of w<sup>ch</sup> even y<sup>e</sup> least y<sup>t</sup> occurrs Influences them in tanto,<sup>27</sup> and have onely y<sup>e</sup> law's of y<sup>e</sup> world or of motion, by w<sup>ch</sup> they are passive as well as active to governe them. The air & water allwais move unStedily, and the current's of them are hindered, diverted, or perhaps aided by other currents of y<sup>e</sup> Same fluid, and allway's Influenc't by obstacles. Why Should Not y<sup>e</sup> Grand Currents of y<sup>e</sup> univers, y<sup>e</sup> celestiall vortexes so Influence  
each

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<sup>26</sup> This is the notation used in astronomical texts to represent the fractions of degrees, see RN's use of the same notation (and a similar scepticism of the claims of exact mathematical description) in his reading of Hayes' *Easy Method* (f. 301r ff, below). RN, as we read here, is generally doubtful about claims of precise, mathematical description, for reasons which should be clear by now, as they are are immanent throughout his epistemology.

<sup>27</sup> i.e., 'anyway' or 'meanwhile', from the Italian.

Each other, as More or less to vary their courses. It is manifest currents of air will pass each other conterminously, as wee see clouds move Severall way's, winds aloft & None below, or perhaps contrary, and Sometimes one Gains upon y<sup>e</sup> other. so the celestiaall Currents may, moving severall way's conterminously gaine and loos sometimes more & & Sometimes less accidentally; So wee see when water runns tho it be between the same banks of the hardest rock, that allwais bear alike to it It shall not run Even & Smooth, but with Eddy's curling's & waving's to, & fro. the like wee May Suppose to happen about the border's of vortexes w<sup>ch</sup> may Influence y<sup>e</sup> figure's In w<sup>ch</sup> the planet's move, and make it more or less curve In Some places, & produce such anomola as are observed. But it was Ever a failing to ascribe Exactness to y<sup>e</sup> heavens, and disorder to the Earth, but it is, So farr without reason, as wee May justly conclude two thing's 1. that It is No disorder that thing's do Not affect Exactly Mathematicall figures, for perfection is as much in Irregular as in Regular things. 2. that there is No reason to Make a difference between one sort & y<sup>e</sup> other, but that those



All those affection's, of what sort so ever they are,  
to w<sup>ch</sup> Sublunary thing's are obnoxious, doe With  
like Energy work upon celestiall body's and that  
as they are greater, so are the Irregularity's  
So to call them More considerable, tho Not Nice=  
ly observable, as comon things are among us.  
can any one say, water out of a vessel projects  
critically a parabolicall figure; It may be  
neer, or Neerer that then any other, but Suppose  
that Extended as far as Saturne, would Not the  
deviousness be vast? Body's are Sayd to fall In=  
creasing swiftness In proportion between time &  
Space, duplicate. It may be neer so, but Not  
mathematically exact, No more are the celestiall  
revolutions.

so as Irreg  
matter<sup>28</sup>

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<sup>28</sup> This marginalia in tiny writing, as a prompt for the next section (not completed)?

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<sup>29</sup>  
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<sup>29</sup> We begin another renumbered section here which runs through to f. 32.

Having In y<sup>e</sup> first part of my intended repository of thoughts, Set down my apprehension's of the Nature, & changes of body, in all y<sup>e</sup> Condition's of it so as to Solve y<sup>e</sup> most considerable phenomena of local motion; I come Now to Consider y<sup>e</sup> world, and nature, in a more generall contemplation. and to this y<sup>e</sup> former was so Elementary, and Essentiall, that I could not have given a plausible or tollerable account of any of o<sup>r</sup> heav'nly, or Mundane objects with /out\ it. but there wee must resort for our argument's & probability's, there being no law's made for great ones, or small body's apart, but all have y<sup>e</sup> Same Nature's & differ in Nothing but Quantity and y<sup>e</sup> neccessary, or inherent Consequences of it. There have bin Many hypotheses, or sect's, who have used severall methods, to satisfie humane curiosity about naturall thing's. of w<sup>ch</sup> Most have bin founded upon Some ffew ingenious Notion's, or thoughts, w<sup>ch</sup> have turned neatly, in some instances; and then all other's have bin forc't into y<sup>e</sup> pale, for Conformity, without holding hard to Reason or probability. and the Most generall mistake is, in grasping at all, and Esteeming themselves defective, if any thing be left unsolved. w<sup>ch</sup> hath brought disesteem, upon philosophy, as a trifling study. and o<sup>r</sup> authors have bin more apt to fall under this Mistake. becaus No person's are interested in their judgm'ts, therefore there is no carefull Refining upon y<sup>e</sup> Subject, to improve men's hints to y<sup>e</sup> height, as in profitable learning there is, so that Men are left to their voluntary opinion's; w<sup>ch</sup> in such indifferent

Matter's are wondrous light and apt to turne any way, as y<sup>e</sup> p<sup>r</sup>sent fancy suggests. and be a thing never so inscrutable, they drop an opinion upon it and the curious, seek's not so much truth, or the just sentiments of things, as to be diverted, and a Notion well penne'd hath better success then one well considered; besides w<sup>t</sup>ever y<sup>e</sup> p<sup>r</sup>cipitation or p<sup>r</sup>=judice of y<sup>e</sup> Composer is, y<sup>e</sup> Receiver's have a greater portion of it, and are for y<sup>e</sup> Most part Supine and careless. but time & fresh witts discover mistakes, as must needs happen, when judgm'<sup>ts</sup> are by Chance, w<sup>ch</sup> disparageth all y<sup>e</sup> Rest, as conjecturall and un=certein. whereas there are Excellent contemplation's and Not onely Most diverting to any Curious fancy but Supported with Experience, and Reason. if the Great undertaker's would keep within y<sup>e</sup> Compass of such bounds, their work's would have y<sup>e</sup> value they deserve. but on y<sup>e</sup> other side, there are other small matter's y<sup>t</sup> they most Converse with, whose Causes are obscured by unscrutable minuteness, and after all possible paines, and industry, taken to Investigate them, y<sup>e</sup> idlest fool in nature may say, perhaps it is not so, & there is not wherewithall to Confute him. I doe not deny but there May be conjectures of any thing worthy the observation of y<sup>e</sup> ingenious but it must be as occasionall, and not as buissness. Not insisted upon with y<sup>e</sup> Same assurance, as other thing's are w<sup>ch</sup> have a devine probability to be assured upon. I might give Many instances of this but one shall serve for all. whose philosophy in Generalls is irrefragable, but in particular's as y<sup>e</sup> shapes

shapes of Materiall part's, for instance y<sup>e</sup> Striated and their assigned motion's, he is as conjecturall as any Ever went before him.<sup>30</sup> and consequently obnoxious to errors, w<sup>ch</sup> time has discovered upon him. The true Method is to begin with y<sup>e</sup> Most plain principles and proceed as ffarr as path's can be found, and w<sup>t</sup> is unknowne leav it so, at least with moderate observations, & overtures. and be content with y<sup>e</sup> defect's of our Natures, without imbar=king/k\ in vast designes of knowing all things. How ffar I shall Contein my self to these methods I can not foresee, but y<sup>e</sup> Sequel will Shew, ffor I am sensible of my owne frailty's, as much as of my fellow creatures, and know how propence I am to use positive Expression's in thing's not perfectly clear, but Glimmering. therefore my previous apology is onely this, that w<sup>t</sup> doth not suit with y<sup>e</sup> principles formerly lay'd downe, or w<sup>t</sup> doth not square with Experience, is Escap't ffrom me, & I Recall it, with all submission to y<sup>e</sup> kind discoverer.

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<sup>30</sup> i.e., Descartes; see f. 29v, below.

I shall first Remember the most Considerable appearances, w<sup>ch</sup> Every one observes, and also other more latent matters, Now disclosed with y<sup>e</sup> help of art, and Examine w<sup>t</sup> sort of solution may be most probable according to y<sup>e</sup> Rules, & law's of Motion.

First the great luminary of y<sup>e</sup> World, y<sup>e</sup> Sun. of w<sup>ch</sup> all y<sup>t</sup> wee know vulgarly, is y<sup>t</sup> he changeth his position to y<sup>e</sup> Earth, or y<sup>e</sup> Earth to him, in 2. Respects. 1. diurnall. by appearing in y<sup>e</sup> East & passing to y<sup>e</sup> west, in y<sup>e</sup> Same or paralell circles. 2. Anuall. by being neerer y<sup>e</sup> pole's of those diurnall Circles, in Summer ~~the~~ /&\ in Winter the in y<sup>e</sup> mean season's. these two Changes are periodicall, and May /be\ Exhibited to our apprehension, Either, by y<sup>e</sup> Sun's Motion or y<sup>e</sup> Earth's. ffor as I say'd formerly, thing's Move or Not Move according as stationary body's determine. Then as to those, wee have neer hand the part's of y<sup>e</sup> Earth, as hills, townes, River's &c. y<sup>t</sup> never chang their site, with mutuall Respect. then these are also y<sup>e</sup> fixt starr's w<sup>ch</sup> likewise have kept their Distances, Ever since there hath bin knowledge of them without any difference sensible to us. There are likewise other planetary body's as y<sup>e</sup> Moon, w<sup>ch</sup> Moves about y<sup>e</sup> Earth, as is demonstrated by y<sup>e</sup> Eclipses, ffor in opposition to y<sup>e</sup> Sun, y<sup>e</sup> Shaddow of y<sup>e</sup> Earth, obscures her face, & in Conjunction with y<sup>e</sup> sun, she intercepts his light.



The other planet's, as Mercury, venus, Jupiter Mars, & Saturne, chang their position as ye Sun doth, onely not anually, by some less, as Mercury, & venus, & other's More as Mars & Saturne, ye latter of w<sup>ch</sup> Returnes not to his place under 30. years. but all have ye diurnall chang, both Moon, & ye Rest, in ye Same Manner, onely their severall greater periods allowed ffor. Some other planets have small ones attend them besides ye Earth (w<sup>ch</sup> I must call a planet) Especially Juppiter, w<sup>ch</sup> hath 4. w<sup>ch</sup> they call his satellites. and have their periodical Motion's, and are duely Eclipst in opposition to ye Sun, in ye Same Manner, as ye Moon is sometimes, and the motion's of ye Satellites are as certein, being reduced to tables, as any other.

Other planet's wee have none, very apparent unless ye Macula<sup>e31</sup> of ye Sun may be Esteemed such, ffor there is No demonstration that those cover ye face of ye sun, or swim at some distance from it. but there are frequently, Erratick body's Eminent ffor a firy train, called Comet's, w<sup>ch</sup> have these property's distinct from other planets as their body's are alwais Misty, & not perfectly terminated, and the stream of light is opposite to ye Sun. and lastly, their appearances, and motion's, are not calculable, but uncertein, and Casuall.

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<sup>31</sup> i.e., 'sunspot'

The planet's are found to be gross & solid body's, as y<sup>e</sup> Earth is, and have no originall light, but, onely by Reflection of y<sup>e</sup> Sun's light that ffall's upon them. ffor their Surfaces are craggy, as y<sup>e</sup> Moon, & Saturne hath Ansa<sup>e</sup>,<sup>32</sup> w<sup>ch</sup> Resemble in all appearance, a Ring like y<sup>e</sup> horison of a Globe, but at Greater distance Mars hath a Cingulum, or Belt cross him whereof luminary's are uniforme, y<sup>e</sup> Satel=lites of Jupiter are Eclipst frequently, venus hath phases like y<sup>e</sup> Moon. and the More distant these planet's are y<sup>e</sup> less discernable these minutia<sup>e</sup> are, but in y<sup>e</sup> Moon that is neer they are manifest, Even almost to shew y<sup>e</sup> landscape of her face. ffor as y<sup>e</sup> light advanceth upon her face, you may See y<sup>e</sup> hills tipt, before y<sup>e</sup> valley's are illuminated, and upon some parts y<sup>e</sup> light much more strong & ffierce, then on others. w<sup>ch</sup> are alwais y<sup>e</sup> Same. Should wee look upon y<sup>e</sup> face of y<sup>e</sup> Earth out of Dark, as wee doe upon y<sup>e</sup> Moon, it would have y<sup>e</sup> same lustrous Shining, but wee see it onely by day, when y<sup>e</sup> master light y<sup>e</sup> Sun is p<sup>d</sup>ominant, w<sup>ch</sup> makes y<sup>e</sup> Reflec=tion faint, as y<sup>e</sup> Moon is when neer y<sup>e</sup> Sun. However, when there are lightning's, & corrusca=tion's in y<sup>e</sup> Night, or, you see y<sup>e</sup> Sun shining out of a cellar, y<sup>e</sup> Earth's faece Shines strongly, and this hath made many thinck, y<sup>t</sup> a prospect of y<sup>e</sup> Earth from y<sup>e</sup> moon, would make it appear

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<sup>32</sup> i.e., 'a looped handle', plural of Latin 'ansa'. These were first observed as an anomaly by Galileo in 1610, who thought that he was seeing three objects, and first 'properly' described as rings by Christiaan Huyghens in 1655.

Much as y<sup>e</sup> Moon doth to us. there is observed a faint light, upon y<sup>e</sup> opac part of y<sup>e</sup> moon Cresscent w<sup>ch</sup> is truely judg'd to be a Returne of y<sup>e</sup> sun's light first Reflected upon y<sup>e</sup> Earth to y<sup>e</sup> Moon & then from y<sup>e</sup> Moon againe to us; So that when we observe y<sup>t</sup> in y<sup>e</sup> moon, y<sup>e</sup> Moon hath y<sup>e</sup> light of y<sup>e</sup> Earth upon it, w<sup>ch</sup> is like our Moon Shine onely stronger, as y<sup>e</sup> Earth appear's larger. this must appear to us most when y<sup>e</sup> Moon is newest becaus then y<sup>e</sup> luminated part of y<sup>e</sup> Earth is most obverted towards y<sup>e</sup> Moon. but at y<sup>e</sup>. 2. & other Quarterly periods, it is not discerned becaus then y<sup>e</sup> opac part, or night of y<sup>e</sup> Earth is towards it. all w<sup>ch</sup> is very Easily Conceivable to any one y<sup>t</sup> will attend it.

It is Not observed that any other planets turne upon their center. tho it is probable that if y<sup>e</sup> Earth Doth, the rest y<sup>t</sup> have satellites, such as y<sup>e</sup> Moon is, doe. but it is Manifest y<sup>e</sup> Moon doth not so turne, ffor y<sup>e</sup> same face is always towards y<sup>e</sup> Earth, and in all probability, other satellites are of y<sup>e</sup> same Nature. as for the Rest of y<sup>e</sup> planet's some seem Retrograde, at some times; w<sup>ch</sup> will be considered as an argument to Corroborate the Systeme I shall fix upon, in due place.<sup>33</sup> but those y<sup>t</sup> are Called fixt Starr's always keep their Station /with themselves\ & chang onely in a diurnal cours about y<sup>e</sup> Earth.

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<sup>33</sup> The rest of this essay had been added later. Note that on the next page the text ends with a semi-colon, suggesting that it was to be continued (although, who would assume anything from RN's punctuation?).

There have bin new starr's observ<sup>d</sup> amongst y<sup>e</sup>  
ffixt ones, y<sup>t</sup> have appear'd , & expired Gradatim<sup>34</sup>  
These are the cheif phenomena of y<sup>e</sup> world upon  
w<sup>ch</sup> I intend to ground my conclusions; y<sup>e</sup> ffact  
I thinck will not be denyed, y<sup>t</sup> y<sup>e</sup> observations are  
as I have Represented them;

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<sup>34</sup> i.e., 'gradually', from Latin

The systeme that I would Establish, tho I thinck it is sufficiently Received already, is that they call y<sup>e</sup> Copernicean, or rather that set forth by D. Cartes. Copernicus Dealt as an astronomer, and onely investigated y<sup>e</sup> planets Motions, Not as a philosopher to Exhibit y<sup>e</sup> Reason's; and y<sup>t</sup> part in generall is admirably performed by D. Cartes. tho in particular I thinck he hath ore'Shott himself, by assigning shapes to y<sup>e</sup> part's, wearing for making y<sup>e</sup> Globuli, y<sup>t</sup> is contrary to his owne principle of Matter, and parts growing together againe to make y<sup>e</sup> Striae,<sup>35</sup> with innumerable others y<sup>t</sup> I need Not Mention. This it is in Short that the Sun is stationary, in Respect of y<sup>e</sup> fixt Star's. & of y<sup>e</sup> same nature, y<sup>t</sup> is ffire. and if they have central Motion's it is all. then y<sup>t</sup> y<sup>e</sup> planet's, whereof y<sup>e</sup> Earth is one, doe Move about y<sup>e</sup> Sun, being Carried in y<sup>e</sup> Stream of celestiall matter y<sup>t</sup> perpetually Rowls. and then y<sup>t</sup> some planets have the like vortications about them, wherein Secondary planet's are carried, such as y<sup>e</sup> Moon, & other satellites. that y<sup>e</sup> anuall period of y<sup>e</sup> Earth, y<sup>t</sup> distinguisheth Summer & winter, and the grand periods of y<sup>e</sup> other greater planets, are performed by this Motion. and y<sup>e</sup> diurnall is

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<sup>35</sup> i.e., abrasion producing rounded forms, and fibres of matter (striae) combining to form entities. Descartes had a complicated 'atomic' theory of differently shaped component parts of matter producing the distinctive forms of matter.

by y<sup>e</sup> Centrall Motion of such planets, as have it, of w<sup>ch</sup> o<sup>r</sup> Earth is one. The moon, w<sup>ch</sup> hath no centrall, but orbicular Motion, hath Day once a Month, & nights as much; for y<sup>e</sup> circle being performed in y<sup>t</sup> time, half is day, & half night the other satellites, as those of Juppiter, have Quicker dispatches, and pass night, & day Every 9. hours. and being constantly Eclipst, seem to be very neer the face of their principall planet, ffor y<sup>e</sup> moon, for y<sup>e</sup> Most part Escapes y<sup>e</sup> Shaddow. ~~ther~~ and is much slower then y<sup>e</sup> Earth, therefore More Remote. this I am to Make probable, upon y<sup>e</sup> principles of y<sup>e</sup> first part; in opposition to other Systemes; as y<sup>t</sup> of Ticho Brahe,<sup>36</sup> who differ's onely in this, y<sup>t</sup> y<sup>e</sup> Sun, & all y<sup>e</sup> Rest of y<sup>e</sup> world move about y<sup>e</sup> Earth, and y<sup>e</sup> other planet's about y<sup>e</sup> sun. w<sup>ch</sup> was but an invention to Evade y<sup>e</sup> Scripture, terra in Eternum stat,<sup>37</sup> but in truth his opinion was with Copernicus. and that of solid orbs, and Epicles; w<sup>ch</sup> is purly arbitrary and by y<sup>e</sup> ordinary Cours of Nature impossible. and to this I shall advance by degrees.

As first wee doe not find any great Compages of Matter any where of any Sort of Regular disposition, and all even y<sup>e</sup> Most obdurate is but a concour's of Minute parts, and frangible with no Mighty force, Even diamond w<sup>ch</sup> is hardest and most rare of any thing, is worne away with rubbing into w<sup>t</sup> Shape artists pleas to give it.

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<sup>36</sup> Tycho Brahe (1546–1601), a Danish nobleman, astronomer and alchemist. He sought to find a compromise between the Copernican and Ptolemaic systems, as RN explains here.

<sup>37</sup> i.e., 'the Earth stands eternally still' (misquoted from the Vulgate: 'Terra autem in aeternum stat', Ecclesiastes 1:4; the King James version has: 'but the world forever stays').

The rest, at best, is but stone, w<sup>ch</sup> a ffall break's, and as ffor Mettall's, they are not simply Such, but artificially made out of stones by fire, however their Substance not so hard but is Easily separated, as y<sup>e</sup> Work's of comon operator's shew. then Earth, water, wood &c. are litle better then dust, and all this but a Speck in y<sup>e</sup> World, w<sup>ch</sup> is a congeries of parts least fit for motion, and such as gravity hath brought together, modified under y<sup>e</sup> Severall denomination's aforegoing. then coming to Expatiate abroad, wee find nothing but devided Matter, as y<sup>e</sup> air & Ether ad infinitum so that there is no guide att all, ffor y<sup>e</sup> forming of those Mighty, nay almost infinitely imens machines as y<sup>e</sup> Sphera fixarum &c.<sup>38</sup> but as before wee have argued, wee must Still argue, that the world is in generall fluid, and that these knotts, or plannets, are Quasi accidentall thing's thatt swim and Move in it as y<sup>e</sup> Cours of them injoyne.

How y<sup>e</sup> Etherial Matter or fluid Came first to gyrate about y<sup>e</sup> Sun, is not y<sup>e</sup> Question, but if it be ask't ~~who~~ how I come to know it doth so, I May answer because I find such massy body's as y<sup>e</sup> planets are, in that cours; w<sup>ch</sup> is as naturall an indication, as y<sup>e</sup> moving of stick's & straw's is of a Current of water.

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<sup>38</sup> i.e., 'the fixed spheres' of the Ptolemaic model.

Ffor those body's must be carried, as float's of timber are in a stream, & not driven thro, as canon bullets are. ffor if they were so forc't thro, first w<sup>t</sup> should continue them in that Motion, ffor a bullet looseth continually, and comes to Rest in a short space comparitively. Next w<sup>t</sup> makes such a calme space about ye planets, when a bullet, makes a flutter & nois y<sup>t</sup> it is heard at great distance, and passing thro so swift, is ye Same as if ye fluid pas't that and if there were violence of y<sup>t</sup> kind wee should be sensible of it, & ye year's had bin at stay long since, without a miracle to Continue our Cours. lastly how Comes ye planets to Move round, if it were vis impressa, it would Carry them strait, Therefore it is Most certein if the planet's doe Move about ye Sun, they Must be silently caryed in a Quiet stream of ye Etheriall Matter, and Not Move by any fforce from themselves.

This confutes Ticho Brahe, for according to him the celestiall Matter must have different courses Contrary to it self. The sun and all ye planets goe about the Earth, w<sup>ch</sup> is one Cours; then ye planets Must goe about ye Sun /& Earth\ w<sup>ch</sup> is another Cours /of all ye same Matter\ and a fluid is capable of streaming but one way at a time. But as I say'd before, I beleev, Ticho Regarded ye law of holy church more then philosophy in y<sup>t</sup> opinion. yet in one great Circulatory Stream there may be other's. lesser, such as serve ye satellites, w<sup>ch</sup> are perfectly distinct, and are carried round, like a solid in ye Great one.



But there are some difficulty's very Considerable, as that they /planets\ doe not chang their distance from

y<sup>e</sup> Sun; 2. that the part's of them being so loos as wee know y<sup>e</sup> Earth to be doe not separate, & so y<sup>e</sup> planets's Come to be dissolved; or that y<sup>e</sup> Same force w<sup>ch</sup> brought or keeps y<sup>e</sup> Matter together, doth Not bring More, & increas them, all w<sup>ch</sup> are so essentiall be solved, y<sup>t</sup> without it Nothing of Nature is knowne. and y<sup>e</sup> Solution of these particular's is y<sup>e</sup> flour of D. Cartes, being the reason of Gravity, an universall principle of Nature, & no intrinsick Quallity of body (as y<sup>e</sup> learned use to talk), w<sup>ch</sup> is all circulatory Motion's Effect's a Separation of Some to, & other's from y<sup>e</sup> Center, w<sup>ch</sup> that I may more clearly deduce, I must Remember a principle in y<sup>e</sup> former tract, w<sup>ch</sup> no mortall contravert's, & is dayly Experience.

A body discharg'd of a Curculatory motion goeth off in a tangent. this depends upon another viz. that Every body will move in a strait line if not Restrained, So that whenever many body's are Deteined in a circulatory motion, they have a force to move in a tangent w<sup>ch</sup>, is a removing from y<sup>e</sup> Center of its Motion, and such Restraint as is not superior to y<sup>t</sup> fforce, will give way more or less, as y<sup>e</sup> difference is, & such Recess from y<sup>e</sup> Center, will take place. this is y<sup>e</sup> principle, y<sup>t</sup> gives y<sup>e</sup> true reason, of gravity, y<sup>e</sup> permanency of y<sup>e</sup> planet's.

Now Supposing, as Wee must, that y<sup>e</sup> whole World consist's of materiall part's of infinitely different shapes, & magnitudes, ffor nothing Ever yet appear'd to Regulate and terminate them. then these being universally carried into a circulatory motion, Must have a tendency in strait lines and to be brought into Compass, must have y<sup>e</sup> aid some o<sup>r</sup>ther force. and that Ariseth ffrom y<sup>e</sup> mutuall agitation of the parts, w<sup>ch</sup> is incessant, so that if you Could have power to discerne y<sup>e</sup> Motion's of all these part's, you could not in their action perceiv this tendency, but it being so that y<sup>e</sup> whole moving about y<sup>e</sup> Sun, the agitation is Spirited by it, (ffor Nothing is lost,) so y<sup>e</sup> Effect I am about to Mention. That is the part's that have most fforce, will p<sup>r</sup>vaile to Receed from y<sup>e</sup> Center, and the parts of less force must Come towards it, & that in perpendicular lines, or y<sup>e</sup> Shortest way; ffor the whole Crowding outward, and all part's having different direction's this way & that way as casual strokes occasion, the vigor of this tendency w<sup>ch</sup> is dispers't & blended in y<sup>t</sup> minute agitation is seen onely in y<sup>e</sup> Effect. and altho no one stroke of one Minute ~~point~~ /part\ upon another can be say'd to force it perpendicular, at least not Many comparitively, yet y<sup>e</sup> p<sup>r</sup>valency being that way and y<sup>e</sup> force of Every stroke passing thro all y<sup>e</sup> Rest of y<sup>e</sup> Matter,

This is a contemplation wherein I have had no little nor unpleasant Enterteinm<sup>t</sup>, because it answers That great phenomenon of y<sup>e</sup> world Gravitation without any new imaginary principle, but upon an action of Recess from y<sup>e</sup> Center, w<sup>ch</sup> is by all agreed necessarily Extant in nature, and yet y<sup>e</sup> vertuosi have bin unwilling to admitt it, altho y<sup>t</sup> action appear's in no other Effect in y<sup>e</sup> World but this. I thinck y<sup>e</sup> fault of it is, that y<sup>e</sup> Easyness of this solution, vilifies it. but they Should Shew where is become y<sup>t</sup> action of Recess, if it be not Here? so great a virtue is Not lost, but this may deserve a particualr discours.

Sensibles are. 1. distinct, 2. Indistinct or Confused. All strang objects are of y<sup>e</sup> latter.

Nature hath No Confusion, So when an object is distinguished by Confusion, It becomes a creature of y<sup>e</sup> Imagination & Not Essent Without .

I made a devison of objects, Into distinct & Indistinct, wee have discours't Much of y<sup>e</sup> former & somewhat of y<sup>e</sup> latter but y<sup>e</sup> great charg is behind. ffor I may say that all that's wonderfull In nature, proceeds from Indistinction or confusion of objects; when many p<sup>r</sup>sent themselves, and wee cannot see the' or know the Item's of w<sup>ch</sup> they are Compound, wee have an Idea that hath Nothing real In Nature to answer it. As when 2. Colours In powder are mixt, & produce a. 3<sup>d</sup>. Not like Either, this Is an Idea perfectly chimeriq. for there is not any Confusion /in\ Nature, it ly's all /confused\ In our apprehension, /and that\ from defect of Capacity. and these powder Colours /In Each particular\ have their reality, & Effects as truely & distinctly after Mixture as before. and what wee doe, or doe not discerne or how, Is ~~nothing~~ /of no Concerne\ to thing's themselves. the Ingenious M<sup>r</sup> Hook,<sup>40</sup> made an Engin of wheels that made pulses in any /musically\ proportion. as. 2. 3 4. 5. or 6. to .1. and so 3. to 2. & y<sup>e</sup> like. this latter is that they call a fifth in Musick. these wheels he would turne first slow, so as y<sup>e</sup> sound of y<sup>e</sup> pulses was distinguishable, and so long nothing Extraordinary was observed but as y<sup>e</sup> motion accellerated, and all distinction of pulses was gon, then began that har=

<sup>39</sup> This section appears to be from an earlier text, although itself apparently dating from after 1705; most of the alterations are in a later hand/pen/ink, similar to that in the preceding section. The opening sentence is a jarring non-sequitur. This would push the general project of 'The World', in the formation offered in this volume, forward in time to c. 1710. We cannot assume that this section 'belonged' to those presently around it before the papers entered the BM collection. This is made clear from the first generation of BM numberings which suggest that, when purchased, the parts were in different volumes, or in another place in the same volume (this topic needs to be researched). My approximate dating of this section is supported by internal evidences such as the reference to 'Sir' Isaac Newton at f. 46r (he was knighted in April 1705). It would seem that this earlier text was set into the subsequently conceived larger work (i.e., that described at f. 1 ff). RN's method of writing involved the production of discrete essays (and frequent reworkings) within frameworks revealed in successive indices and contents pages. The consistent use of marginalia in this text can, perhaps, be read as indicating a movement towards a more 'publishable' text.

<sup>40</sup> Robert Hooke (1635-1703); I am currently seeking to identify the experiment RN describes.

Harmonious Ringing of y<sup>e</sup> Musitian's fifth,  
 w<sup>ch</sup> in Imagination, was a creature of  
 meer Confusion, and Not ~~Elswhere In nature~~ /otherwise  
 existent\  
 And all /those\ other way's of perceiving, /w<sup>ch</sup>\ wee call  
 senses, have the same faculty, Even light  
 & colours, are but the Result of confused ap=  
 prehension of Numerous pulses on y<sup>e</sup> organ, as  
 may be more largely dicours't Elswhere.

The variety's wee  
 admire In y<sup>e</sup> World  
 are from this Shop  
 of Confusion, for  
 Nature hath No  
 chang, but what is  
 Referable to Meer  
 Extension.

It is No wonder then that wee are Sensible of  
 so much variety In y<sup>e</sup> world, ~~that~~ /who\ are so full of  
 defect, as Not distinctly to know any Consid=  
 erable object. And for want of knowing which  
 things truely are, wee frame Essences for them  
 out of our Imaginary Ideas; thence those Ideas  
 w<sup>ch</sup> are diversifyed, by y<sup>e</sup> organ's of sence, and  
 admitt Infinite variety under Each, are ac=  
 counted the variety's of Nature, altho Infinite  
 nature hath No chang of variety, but what  
 falls out In More or less of Extension. tis true  
 the Notion's, of Great small, fast slow, here  
 there, high low & y<sup>e</sup> like are In nature as  
 Wee Imagine them. but light, dark, Red  
 Blew, sound, consonance, dissonance, Soft  
 hard, hot cold, & y<sup>e</sup> like are all owing to  
 the Internall mode of perceiving, and  
 belong's Not to thing's, however ~~the~~ /these\ other  
 variety's y<sup>t</sup> Nature hath /admitts\  
 to our fancy, to enterteine such Ideas.

The mean's of know=  
ing, what is true  
& what is but I=  
Maginary, are hard,  
and Require Ex=  
clusion of all p=  
judice.

Some Confused ob=  
jects are Reduced  
to Simplicity by  
Microsee /experim<sup>t</sup>s\  
as Coleur  
mixt, are resepe=  
rated with help of  
a Microscope.  
So of Musicall Sounds.

Chimistry rather  
deteet's /confutes\  
Errors the  
then  
establisheth truth;

How hard then is it for us to judg of objects  
so as to determine what is true, and what  
Imaginary? Wee Must doe violence to our Na=  
tures, and thro off all p<sup>r</sup>judice, giving No autho=  
rity to our Imagination, but seek truth from  
Reason, and Guide that by comparison of  
thing's, in severall states & Relation's.

In disquisitions of this nature, wee find ~~Some~~ /divers\  
cases of comixt or Confused sensation's w<sup>ch</sup>  
afford some mean's of Inspection or exami=  
nation; as by y<sup>e</sup> help of microscopes, wee can  
see colours, & when mixt, find out the In=  
gredients of such mixture, as the blews &  
Green's. &c. distinct; and wee can readily  
analise Musicall sounds, and discover that  
the continuance of them is an Idea Made  
by confusion; ffor the nature of them is on=  
ly pulses succeeding one and other, made  
so fast, wee cannot distinguish them. and  
when the times are Regular, that they  
give us the Idea's of harmony. And chimis=  
try, w<sup>ch</sup> is an art of tearing and tormen=  
ting bodys, & making y<sup>e</sup> homogene Matter  
of them assemble, of w<sup>ch</sup> there was No signe  
or token, as wee could perceiv In the totum.<sup>41</sup>  
and thence many discoverys of Error's, rather  
then Establishm'<sup>ts</sup> of truth, are made. and y<sup>e</sup>  
like may be in other sorts of Experiment.

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<sup>41</sup> i.e., 'whole', from Latin

The Mundane Systeme, is cleared from confusion, and y<sup>e</sup> consequent vain Imaginations about it, by telescopes.

A short description of it. Into planets, primary & secondary, & sunn's, & then of Comets.

I must not omitt to mention the glorious discovery's in the heaven's by y<sup>e</sup> mean's of telescopes, w<sup>ch</sup> hath Reduced the Mundane systeme, from being a subject of meer fancy, to such certeinty, as Now there is No reason to doubdt by what reall changes In the heaven's, those various appearances of y<sup>e</sup> planets, as to places & magnitudes, are occasioned. That is That the sun hath a station with regard to ~~the Rest~~ /other Starrs\, Neerly as a center; and that y<sup>e</sup> body of it hath Revolution's; ffor the maculae first appearing, passing over the disk, and then disaparing, move in such manner, and proportion of time as by Experimentall rules of Globes turning, must argue y<sup>e</sup> body of y<sup>e</sup> sun, to Revolve accordingly. Then that the prime planets, y<sup>e</sup> Earth mercury venus mars Jupiter and Saturne, revolve about y<sup>e</sup> sun, Slower by distance, and all neer y<sup>e</sup> Equator of the sun's orbit, they call y<sup>e</sup> eccliptick, /not much\ swerving ~~but very little~~ Either way towards y<sup>e</sup> poles. Then that divers of these prime planet's, If Not all, Revolve; w<sup>ch</sup> wee of the Earth, know by y<sup>e</sup> difference of Night and day; and that there are secondary planet's or moons, that Revolve about y<sup>e</sup> prime, and so attend In all their Courses.

That

of Comets, seen by  
ye Steam or Smoak  
that flows from 'em  
w<sup>ch</sup> demonstrates  
Gravity & levity in  
ye Ether, for all  
moves & points  
from ye Sun.

Comet's that doe  
Not Steam, May  
Not be discerne=  
able.

That the first starr's, by strength of light  
and Immesurable distance, have the Na=  
ture and condition of Sunns, and No Chang  
of place is knowne amongst them, ~~or~~ /with\  
~~of any with~~ ye Sun. tho Some /starrs\  
appeared, and againe dissapeared. And  
Thence it is Concluded possibly, that the  
analogy of our solar systeme, may. hold  
In others; that is Revolutions planets  
prime & secondary, /tho Not discoverable for faintness of  
light\ as here. And lastly that,  
Comet's differ from planets, 1. as having No  
setled orbit, or Cours; tho the vertuosi are  
So /zealously\  
Inclined to make orbit's for them, that  
rather than fail, will /they\  
obtrude /Immens Elipticks  
upon\ em. but till  
It be manefestly proved, wee must take it  
for granted they have None; but yet /they\  
Move  
In courses Regulated as all projectiles doe,  
by lines they call trajectory; and Next. 2.  
that ye body of them is in a condition of  
much Exhalation, Either of Smoak or Mist,  
but rather ye former, and that Excited by  
fire, tho it is Not discernable, and perhaps  
like ye Solfa-terra<sup>43</sup> In Italy subterrane,  
would Not be seen If ye Smoak were away,  
but that they are alike in Massiff Sub=  
stance, solidity & borrowed light. And It  
is

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<sup>42</sup> i.e., 'newly', i.e.: Novae

<sup>43</sup> i.e., 'land of sulpher', a name given to an area in Pozzuoli, near Naples, and also to a shallow crater there.



These matter's of  
comon Erudition, &  
Not minutely de=  
clared here.

The Caus and Con=  
servation of all  
y<sup>e</sup> celestiall Courses  
Referred to y<sup>e</sup>  
law's of simple  
& mixt motion,  
& attraction but  
a Subterfuge.

is farther discovered, that the Comet Moves thro y<sup>e</sup> Ether, by a force acquired, as other body's move thro aeriall fluids. partly be= caus the smoak goes from it; But that is also a proof of Gravity & levity In all part's of y<sup>e</sup> Ether, farr from y<sup>e</sup> Earth, and that it is directed to and from y<sup>e</sup> Sun. ffor the Exhalation, is always directed from y<sup>e</sup> Sun, w<sup>ch</sup> is as the result of levity; as smoak as= cends with us. Much more is observable of comets, as well as of all y<sup>e</sup> planet's In par= ticular. but I am Reserved, to y<sup>e</sup> place of Each in these papers, for discours of them. And here I touch onely In generall, the maine lines of y<sup>e</sup> Mundane System, being In our time knowne, & allow<sup>d</sup> by those who know any thing, of naturall philosofy.

The discovery as well as proof of all these matter's have Growne In y<sup>e</sup> world from y<sup>e</sup> use of telescopes, w<sup>ch</sup> have disbanded all other system's of y<sup>e</sup> world, as meer figments of vulgar thinking, or wors. But still wee are In y<sup>e</sup> dark as to y<sup>e</sup> causes, & Influences y<sup>t</sup> Rules the motion's of these Immens lumps, It is one thing to know how they move and another, why, or how occasioned, & conserved. Some have had, as I have touched, a fancy  
that

All knowne Expe=  
riment's of force  
Reduce it to Such  
laws, why Not to  
take place, where  
Experim<sup>t</sup> failes?

that, they attract one & other, w<sup>ch</sup> perturbes  
their courses, and causeth all y<sup>e</sup> anomala of  
their movem<sup>ts</sup>. All w<sup>ch</sup> is Gratis dictum.<sup>44</sup> and  
when wee ask 'em what is attraction, then  
they ans<sup>r</sup>, It may be Impuls, or Some other  
force unknowne. as for this latter, wee may  
be allowed to pass it over. and for y<sup>e</sup> other,  
since wee can prove y<sup>e</sup> laws of Impulses, by  
sensible experim<sup>ts</sup>, why doe we Not take  
that Cours, and see how farr it will Carry us.  
No say they, It will not carry us thro, so  
sensibly, as wee have proof in simple Instan=  
ces, therefore wee not have to doe with that  
method. here is [Jugulum?] Caused. I would ask  
If It be possible for us to obtain discovery of  
these powers, or yet unknowne Causes, to a  
greater degree then w<sup>ch</sup> the nature of Impuls  
is knowne? or If the knowledg wee have of that  
be not distinct & satisfactory? or If /Miracles apart\ any  
Expe=  
riment since the creation, yet made knowne  
any other mean's of force or motion, then  
corporeal Impulse? or If a thousand Compound  
or Confused effect's, upon Scrutiny, Notwith=  
Standing, the peculiar Images they Create  
On our ~~Ima~~ ffancy's, have not bin found, to  
be the Event of comon Impuls? Then why  
Should wee Not, with all y<sup>e</sup> force of our under=  
standing's & Invention's, search all possible  
consequences

---

<sup>44</sup> i.e., 'told for free', a Latin legal term, in this context meaning 'offered without proof'

In vaine to Ex=  
pect discovery's  
beyond y<sup>e</sup> power  
of our faculty's  
to discerne.

All Imaginary  
forces layd aside  
and rather then  
admitt such, be  
Ignorant, & Expect  
discovery's.

Consequences of Impulses simple & mixt, and  
then Compare them with the phenomena of  
Nature, and If there may be a consonancy  
of them, conclude one y<sup>e</sup> caus of y<sup>e</sup> other? and  
not Expect till doem'sday discovery's of things  
wee know not whither such be, or not, so farr  
from solution's or consequences to be had that  
way? Upon such Reflection's ase as these, made  
with my self, I have determined, to look no  
farther for a Resolution of the Mundane  
Systeme, then from y<sup>e</sup> doctrine of Impulses.  
And persuant to that porpose, I thinck I  
ought to let no property, or Event of that sort  
dropp; but If I know it from simple tryalls, or  
y<sup>e</sup> Consequences of them, Expect to find them in  
the Grand Mixtures of Effect's In y<sup>e</sup> World In  
whatever shape they take In My Imagina=  
tion; And If there are Such, as I owne some, &  
Not many, w<sup>ch</sup> I cannot accord with any  
Instances of Impulsive force; there I sitt downe,  
and Expect a door to be opened, by farther  
discovery's, whereby I may Gaine a Connexion,  
and Not to lett in New, or Imaginary prin=  
ciples; and y<sup>e</sup> mean time be Content so to bide  
In harmeless ignorance. And how ffar I  
can from light others have Given and  
my owne speculation's, carry this philosophy  
must be left to y<sup>e</sup> Indifferent to Judg.

All y<sup>e</sup> Celestiall matter as a stream flow's about y<sup>e</sup> Sun, and y<sup>e</sup> planets float silently in it as loggs In a 'current of water.

planetary Courses judged by observing divers things but as to y<sup>e</sup> ambient Ether, they are as Not Moving at all.

first to begin with y<sup>e</sup> Sun, and the vast Sphear about it, In w<sup>ch</sup> y<sup>e</sup> planets move. The very transit of y<sup>e</sup> planets demonstrate, that the whole Continent of the Etheriall matter Moves about or rather with y<sup>e</sup> body of the Sun. ffor If those body's were not Convoyed In the Ether, there must be much disturbance, as of ruffling wind ag<sup>t</sup> the Surface of them; as when y<sup>e</sup> wind bears ag<sup>t</sup> houses and walls, and this whither y<sup>e</sup> planets are Supposed to Rest, or to Move opposite to y<sup>e</sup> Ether. but It being Manifest that y<sup>e</sup> Earth, w<sup>ch</sup> proves y<sup>e</sup> Rest, is free from all Such tumult, wee Conclude that y<sup>e</sup> Ether and the planetts move together, as Great timbers, or boat's pass silently In a Current, without any ruffling or stirr at all, as happens when anchored downe in a tydes way. Besides, wee must consider that If a planet as a lump without motion were put Into y<sup>e</sup> Ether, and consequently be thus borne upon by it, It Must In due time acquire a Conformable Movem<sup>t</sup>, as wee doubt but is at the p<sup>r</sup>sent y<sup>e</sup> Condition of them. And however to us, there is a Motion of y<sup>e</sup> planets apparent, becaus wee regard the position of many things, by w<sup>ch</sup> wee Judg of motion, yet If wee regard onely y<sup>e</sup> planet & the

the conterminous Ether, wee cannot Say y<sup>e</sup>  
planet moves at all;

The cause of this  
generall rotation  
Referred to y<sup>e</sup> Cre=  
ation of all things.  
but accident's May  
alter & chang one  
condition for ano=  
ther as stream's  
chang their Cours  
& y<sup>e</sup> like.

Changes & Inequa=  
lity's In y<sup>e</sup> heavens  
to us Slow, & Not  
allwais regarded  
as whither, hour's  
day's, years, &c are  
all alike &c.

As to y<sup>e</sup> caus of this vast Rolling condition  
of y<sup>e</sup> Ether from y<sup>e</sup> Sun's Surface, and to the  
region's of y<sup>e</sup> fixt starrs, I must Referr it to the  
beginning of thing's, the fiat, of y<sup>e</sup> Almighty.  
but /if\ from thence /or any second caus\ having such a  
movement is  
Given, I say, It Must Continue, till a Suffi=  
cient force Interposeth to Stop /or divert\ it. I cannot  
affirme that It cannot, or will never happen  
ffor it is Naturally possible, that a greater  
body, with Swifter force, and opposite direction  
may In process of time Gaine Ground upon, &  
at length destroy it. And on the other side  
This may Gaine on others, and so perhaps  
fluctuate one way & other, with alternations  
of loss & Inlargem't, till the Almighty's will  
turnes y<sup>e</sup> scales, & put's an end to our world,  
by destroying the main wheel of its work, &  
so all parts and members of it, fall asunder  
& are dissipated. but considering according to  
body, is not readily checked, And If a power  
p<sup>r</sup>vailes to doe it, comparing time with Quan  
tity of substance, 5000 years, would be a trifle  
In y<sup>e</sup> process. And whither there hath bin any  
Great alteration, since y<sup>e</sup> beginning, In the  
length of time In y<sup>e</sup> Revolution's, wee Cannot  
well

In truth those are perpetually un= equall, as astro= nomer's find, who allow, by y<sup>e</sup> Name, anomala, for un= accountable Irre= gularity's

No Mathematick exactness ffound In y<sup>e</sup> orbits, but y<sup>e</sup> figre of them y<sup>e</sup> neerest Ellip= ticall.

Circles are apt on coartation to degenerate Into ellipses

well observe, ffor y<sup>e</sup> revolution's are our Mea= sures of time and what should Measure them? pendulum's, you will say, but who hath kept y<sup>e</sup> account? And the time of one mans obser= ving age, is as Nothing to y<sup>e</sup> Subject; but after all wee know there are variation's, so that Every Revolution differ's In time from another; ~~so~~ as there is Not reason to beleev, any two years months Weeks, or day's, were Exactly Equall since y<sup>e</sup> Creation. So litle reason doe I thinck there is ffor mathematicall Exactness to be Required In the planetary Courses, but rather that as all other Effect's of Complex motion and agi= tation of numerous, & unequall part's of Matter and of various & Irregular Shapes, those Revo= lutions of the planetts, must ever fluctuate one way & other, & never Stand in Exact ballance of time. And So ffor y<sup>e</sup> forme of their orbits, If circular or elliptick, the vulgar Eye say's y<sup>e</sup> former, but as y<sup>e</sup> Astronomer say's, & proves Neerly, y<sup>e</sup> latter, but I thinck Exactly Neither; but as vortication's In Currents are apt, by any accidentall ~~Coarctat~~ Coarctations, to dege= nerate Into Ellipses, or towards that forme, so The Revolution's of the heavenly matter, may by some straitnings, or Extravagent liberty's In some region's, be drawne out one way, being pincht in another, & so take y<sup>e</sup> forme of an

of an Ellips. And this is proved by one Notable circumstance, w<sup>ch</sup> is that the orbits of all y<sup>e</sup> planet's are drawne out, that is y<sup>e</sup> longest diameter of all of them points to the same Region, or towards y<sup>e</sup> Same fixt Starre; w<sup>ch</sup> must happen from Some Caus, w<sup>ch</sup> is comon to all as that w<sup>ch</sup> Influenceth the vortex, In w<sup>ch</sup> they all Reside doth.

S<sup>r</sup>. Is. N. argues ag<sup>t</sup> this. from a necessity of the cours wasting.

Nothing Naturall can act thro va=  
cuity.

S<sup>r</sup>. Is. N. is pleased to lay aside, all this Ether or celestia<sup>l</sup> matter, and calls it a figment with other Contemptuous language, and Sub=  
stitutes in y<sup>e</sup> room of it, vacuum. And the planet's are Carryed by a vis Impressa, or con=  
tinuance of motion; w<sup>ch</sup> In vacuo<sup>45</sup> Must be Eternall; whereas, Say's he, If It were carryed by y<sup>e</sup> elas Imagined Ether, it must Continually wast, as all motion's among us are observed to doe. to this, 1. as to the Silly Invention of Ether, and the more worthy vacum, I have say'd Enough Elsewhere; onely here I will Re=  
member that It is as Ingenious to suppose body's to act upon Each other by Contact mediate & Immediate, as to Impose on us such contradiction as it is, for light, attraction & other Influences, If any be, to act thro a vacuum. 2. as to the vis Impressa, w<sup>ch</sup> he Say's Is in directum,<sup>46</sup> but drawne Into an Ellips by attraction, w<sup>ch</sup> I will Not Call figment; I ans<sup>r</sup>  
It

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<sup>45</sup> i.e., 'in a vacuum'

<sup>46</sup> i.e., 'straight ahead'

The Ether more  
proper to be prime  
In y<sup>e</sup> Movement  
of y<sup>e</sup> planets them=  
selves.

proved that at=  
traction able to  
draw y<sup>e</sup> planet  
Into an Ellips  
Must abate its  
cours.

Note

It May be Say'd,  
attraction May  
give, as well as  
take, Speed.

<diagram>

/If there must be Ether\ It seems more reasonable to  
ascribe, y<sup>e</sup> prime  
movement to y<sup>e</sup> Ether, & Not to y<sup>e</sup> planet; ffor  
the latter is a straw & compared with y<sup>e</sup> Mag=  
nitude of y<sup>e</sup> other, (that is as y<sup>e</sup> Sea), is /&\ Inconside=  
rable. And y<sup>e</sup> whole Ether may Easily be Suppo=  
sed to give motion to y<sup>e</sup> planets, but It is Not  
possible those could Ever give Movem'<sup>t</sup> to y<sup>e</sup> Ether.<sup>47</sup>

I doe the rather take this part, of making y<sup>e</sup>  
motion of the planets to be as solids cum fluido<sup>48</sup>  
~~rather then~~ because the objection of wasting will  
fall much more to y<sup>e</sup> Share of the other way,  
w<sup>ch</sup> gives them a Motion as projected In vacuo.  
In Either, so farr as freedome is, the tendency  
of a planet is in directum by a tangent to  
its orb. And that attraction from or towards y<sup>e</sup>  
center, w<sup>ch</sup> curbs it Into an Ellipps, must  
by so much hinder the speed of y<sup>e</sup> planet, &  
In time, wast it Quite. ffor what force soever  
gives a body a different determination, a=  
bates y<sup>e</sup> velocity, more or less. as a Body D.  
moves In y<sup>e</sup> arch a.E. and a force, by the line  
of attraction. C.B. draws y<sup>e</sup> body from B. to E.  
w<sup>ch</sup> line C.B. is opposite to the direction of  
D. by D.B. and so as one body Impelling  
another tho in y<sup>e</sup> least obliquity abates the  
velocity somewhat, so the attraction by the  
obliq line C.D. doth y<sup>e</sup> like. and this force  
works In Every moment of time. ffor this  
reason

<sup>47</sup> Change of pen from here on.

<sup>48</sup> i.e., 'as, or like, fluid', that is: 'solids behaving like fluids'



Attraction to y<sup>e</sup>  
center, from a  
direct cours,  
also abates the  
Speed.

A.  
Note, why doe Not  
these twitchings  
& revulsions of y<sup>e</sup>  
planets, by attrac=  
tion as they pass by  
one & other, vary  
y<sup>e</sup> diameter of y<sup>e</sup>  
orbit's more Conside=  
rably, then is  
observed.

The whole world is  
a perpetuall Mo=  
tion, but No part  
separated Can be  
so.

If a body be bound to a Center by a cord,  
(abstracting all Gravity) and a motion In  
directum Impres't upon it, whereby It takes to  
a Compass motion, this shall Not last So long  
as a motion with like Impuls strait on In  
the same medium; ffor all that straines u=  
pon the Center, is hindrance of y<sup>e</sup> Motion,  
ffor it amounts to an Impuls of the ~~t~~urning /circulating\  
body upon y<sup>e</sup> Center, tending to draw it, &  
If not fixt too well, It would ffollow. Therefore  
I see Not why the planet's should Continue  
long to move In their orbs, when a ligature  
by attraction to y<sup>e</sup> center, must be a vast  
hindrance of their Speed. /A.\ And what /w<sup>e</sup> then\  
are all the operose demonstration's Grounded on y<sup>e</sup>  
vires centripeta<sup>e</sup>,<sup>49</sup> but spinning a long thredd  
out of a shaddow of flax. But If the Motion  
be ascribed primarily to the Ether, as a fluid  
In Motion, and y<sup>e</sup> planet's Innatant<sup>50</sup> In it,  
what should Ever obstruct that Movement?  
I am sure Nothing but the asperity's about  
y<sup>e</sup> Confines Interfering, perhaps, with other like  
vortexes. And as those may happen to hinder  
they may as well help, and so alternately,  
one y<sup>e</sup> other. w<sup>ch</sup> cours may last without Mi=  
racle ages Enough, and If there can be a  
perpetuall motion, this machine of the Infi=  
nite worlds, Is y<sup>e</sup> onely one, and w<sup>ch</sup> onely an  
act of providence Must determine.

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<sup>49</sup> i.e., 'centripetal force', from Latin

<sup>50</sup> i.e., 'swimming or floaring', from Latin

Gravitation is  
that w<sup>ch</sup> librates  
y<sup>e</sup> planets so as  
to Retein their  
orbs.

As to the libration<sup>51</sup> of y<sup>e</sup> planets, that is their  
orbs, w<sup>ch</sup> would be strait courses, but for some  
power wch Constraines them to a Compas; I  
thinck It depends wholly upon Gravitation,  
and that so Naturally, or conformable to  
y<sup>e</sup> ordinary cours of y<sup>e</sup> world, that I must needs  
wonder, when Cartesius had y<sup>e</sup> good happ to  
discover it, that the curiosoe's Should ever part  
with it, as they seem to have done, by set=  
ting up a chimera of attractive powers  
ag<sup>t</sup> mechanicall Consequences of body & /y<sup>e</sup> motive\  
Impulses of it. ffor Such is Gravity, according  
as wee have it from Cartes; but wee decline  
his Minutiae, and take onely the generall  
sceme, let y<sup>e</sup> Item's be what they will.

The Manner of  
it.

Wee Must at p<sup>r</sup>sent have admitted (the /mechanick\  
reason to be given In another place.), that  
the whole celestiall Matter from y<sup>e</sup> Sun's Sur=  
face (~~not to Mention here y<sup>e</sup> /condition very\  
Materiall /  
of\  
it~~) with  
self /Respect to y<sup>e</sup> Sun's center) is Induced or\  
hath in  
it the power of Gravity and  
levity, and all body's Innatant ~~In it~~ /there having also\  
~~are~~  
Gravity or levity In some degree are\  
Influenced by it,  
Either to Move ~~to from~~ /from, towards\  
, or  
be ballanced at y<sup>e</sup> Same distance from y<sup>e</sup> Sun.  
And that this power is Greater, as there is ap=  
proach to y<sup>e</sup> Sun, and less according to Recess  
from it. Then It will ffollow, that If the totum  
of any body, or compage of matter, placed at

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<sup>51</sup> i.e., 'minor fluctuation'

the rules of hydrostatics takes place, In y<sup>e</sup> Ether

Note

The Experiment<sup>t</sup>. of Images In water by a power Compressing y<sup>e</sup> fluid, ad libitum,<sup>52</sup> made to rise, sink, or stand, as they Intend, & so amaze y<sup>e</sup> vulgar. that Instrument Carried about, convey's y<sup>e</sup> Images along, still Influenc't by weight to y<sup>e</sup> planets, &c.

at any given distance from y<sup>e</sup> Sun /and\ hath\ving\ a determined force of Gravity or levity, compared with the force of so Much Ether, as In that Region, as Would ffill its place, If away; must Move towards a ballance of both those powers as If the Ether there be lighter, that is tends from the Sun, It shall make y<sup>e</sup> body give way, & descend. If the body, such as wee suppose a planet, be the lighter, then the Ether must give way to that Moving farther from y<sup>e</sup> Sun. Now wee take the specifick Gravity or levity of a planet, as of Every other thing, to be y<sup>e</sup> Same in all places. but that of the Ether is more, as distance is from y<sup>e</sup> Sun. Then when by the force of Either, the distance /of the planet\ alters, to or from y<sup>e</sup> Sun, It cannot goe to Extremity, becaus Every space Moved is neerer to the place or distance where y<sup>e</sup> forces ballance; and there y<sup>e</sup> planet takes a station, and absolute Compliance with y<sup>e</sup> orbicular cours of y<sup>e</sup> Ether. And If by any vis Impres't & tangent. Recess /or other accident\ the planet hath a fling outwards it is by this principle readily /but silently\ Reduced; so Coming downe to [...?] towards y<sup>e</sup> sun is In like manner Repelled whereby somewhat More, or less, scarce perceivable by us, the plaet keeps to its orb.  
and

---

<sup>52</sup> i.e., 'at its pleasure'. The Experiment is described below at f. 41v,

The anomala  
shew that acci=  
dent's happen to  
y<sup>e</sup> planetary as to  
other Motion's to  
disturbe them.

The heaven's dif=  
fer from common  
sensible body's In  
action onely In sci=  
tuation & Magni=  
tude. wee find No  
attraction In Com=  
mon bodys. what  
disorders them May  
disorder y<sup>e</sup> Greater.

[q<sup>a</sup> penning.?<sup>53</sup>]

And, If deviations are; there is need Enough  
of such accident's to answer some anomala  
of their movement's, w<sup>ch</sup> Astronomers Can  
Give No account of, or at least the Never  
failing Error's, or failings of astronomicall  
tables & Ephemerides, w<sup>ch</sup> grow by time &  
no Exactness at p<sup>r</sup>sent, will hold tollerably  
just, In some ages to come; as None have  
proved so for ages past, w<sup>ch</sup> hath deprec=  
ated the labours of y<sup>e</sup> Noble Tycho, and  
the Composer's of the Rhodolfin tables & others.<sup>54</sup>  
I know it is a prone Imagination and savours  
of the old opinion's de celo,<sup>55</sup> that they are  
Immutable & Incomptable, as the ancients  
held, & now wee, that y<sup>e</sup> orbits of y<sup>e</sup> planetary  
movements must be most p<sup>r</sup>cise & Exact, a  
fitt subject for Mathematicall demonstration,  
whereas, I can find No reason to ascribe to  
y<sup>e</sup> bodys y<sup>t</sup> are distinguish't onely by place &  
magnitude, any p<sup>r</sup>ogatives or regularitys More  
then others have; but Suppose that /what\ Effects /  
ffollow\ of  
/frow\ Irregularity In the /formes of the\ minutest of  
matter, ~~to have~~  
~~such power as to~~ /The like must\ affect all aggregates,  
and  
systemes of matter In y<sup>e</sup> world with Irregularity /however  
great\  
and /that\ what /disorders\ wee see in comon whirlepoles  
of  
water, may be more or less found In the Great  
vortexes of y<sup>e</sup> heavens. Nor doth this att all  
undervalue

<sup>53</sup> This in tiny script, as if a note to himself.

<sup>54</sup> From now on in another ink/pen.

<sup>55</sup> i.e., 'from zeal/enthusiasm', from Spanish

perfection, So Much ascribed to heavenly body's, Consist's not In Shapes & symmetricall comparison. for y<sup>e</sup> Most Irregular forme hath Equall dignity, with y<sup>e</sup> most regular Since the Essence is y<sup>e</sup> Same of both. organization where it is, is y<sup>e</sup> art of y<sup>e</sup> Maker & Not y<sup>e</sup> Matter.

The Experiment of Images, before hinted.

undervalue one or other; for perfection Consists Not in perfect circination, or shapes regulated according to Mathematick definitions but the most Irregular part, is as worthy & perfect as that w<sup>ch</sup> is most Regular. Each filling its place alike, & without any deficiency. why then must Regularity belong more to the Imens more then to y<sup>e</sup> Minute systeme's of matter? To conclude therefore this discourse I repeat, that the planet's are librated In their places by Gravity & levity, according to y<sup>e</sup> Rules of fluido-staticks; concerning w<sup>ch</sup> I will Subjoyne one ordinary Experiment.

let water be put into a Glass with a broad aperture, and Imers In It some body a litle hollow but perforated onely underneath, so that y<sup>e</sup> Included air shall Not escape; but y<sup>e</sup> water may by Entering, by with y<sup>e</sup> force it hath Compress it. contrive by adding or substracting weight, to pois this body In y<sup>e</sup> water, so as to be almost Indifferent as to sinking or swimming the Covering y<sup>e</sup> Glass with a bladder bound about it to Interrupt all Communication with y<sup>e</sup> outward air; and then pressing in the bladder by degrees, whereby y<sup>e</sup> air within above y<sup>e</sup> Water is Compres't, y<sup>e</sup> Water will be driven at the foramen<sup>56</sup> of y<sup>e</sup> body, till y<sup>e</sup> air there takes y<sup>e</sup> same Compressure. and then y<sup>e</sup> Mass is become  
so

---

<sup>56</sup> i.e., 'an opening', now principally a term used in anatomy to describe an opening (from the latin *forare*, to bore or pierce).

so Much heavyer, and will Sink to y<sup>e</sup> bot=  
 tom, and Releiving y<sup>e</sup> Compressure aloft y<sup>e</sup>  
 body will rise againe, by what degrees, &  
 Rest In what place, you will, by mana=  
 ging the Compressure comand. And Note y<sup>t</sup>  
 In Every degree of Sinking the cavity fills, &  
 rising Empty's, not onely from the Compressure  
 aloft, but from y<sup>e</sup> weight of y<sup>e</sup> water it self  
 w<sup>ch</sup> is more compres't low then high. thus  
 the Nugivendula<sup>57</sup> p<sup>r</sup>tend to a magicall power  
 over Images they make to follow one & other  
 up and downe In water, and Not a litle a=  
 muse y<sup>e</sup> Comon people. ffor they will Make  
 them hang & goe as /they\ will without any ready  
 discovery of y<sup>e</sup> means by w<sup>ch</sup> they doe it. And  
 as the poet's having dwelt long on a simile,  
 conclude short, as after /a long\ description of the  
 felling an oak tree, - so fell hector. So /I\ after  
 this Experiment described, Conclude, so  
 hang y<sup>e</sup> planets.

of Gravity &  
 levity, w<sup>ch</sup> hath  
 Infinite vertue  
 In the dispositi<sup>on</sup>.  
 of thing's In the  
 world.

So Much depends on Gravity & levity, both  
 In y<sup>e</sup> heaven's and about us on Earth, and  
 probably In other planets; that I thinck it  
 is Not possible to be too Curious & Judaga=  
 tory about the true Mechanick caus of it.  
 And that Shall be my next undertaking,  
 In w<sup>ch</sup> I must, as In other's particulars, owne  
 much /all\ to y<sup>e</sup> discovery of des Cartes, on whose  
 model

---

<sup>57</sup> This is a term that comes up in a number of early-modern neo-latin texts, It seems to be used to describe primitive, shamanistic magicians.

modell wee work, p<sup>r</sup>tending cheifly to  
prune or Improve what he hath so well  
planted.

The Sume of y<sup>e</sup>  
Impulses of y<sup>e</sup> Mi=  
nute part's of E=  
ther, upon Each  
other, wherein y<sup>e</sup>  
uniforme fluidity  
consist's, amounts  
to carry from ra=  
ther then towards  
y<sup>e</sup> Center, as the  
state of y<sup>e</sup> forces  
of Each are, Com=  
pared with Each  
other.

Hence vacuum  
If any would be  
at the Center.

Besides this Motion of y<sup>e</sup> whole Ether round  
the Sun, there is the Intestine agitation of all  
y<sup>e</sup> part's of it, wherein its fluidity Consists,  
and w<sup>ch</sup> Renders the Mixture, or Composition  
of its part's uniforme. The consequence of these  
two Movements is that Every Individuall  
part hath a tendency In directum, w<sup>ch</sup> is  
conserved thro all the various, & perhaps  
Contrarient pulses it meet's with. So as If  
the path of any one part were traced, It would  
Not be seen that there was a Motion more  
from, then towards y<sup>e</sup> Center; but yet In the  
aggregate, ~~that is~~ the consequence /is\, that y<sup>e</sup>  
whole bear's outwards from the center, and  
the force of the minute Impulses of y<sup>e</sup> fluid  
are more effectuall that drive from, then those  
w<sup>ch</sup> drive towards y<sup>e</sup> Center. Thus ffar will be  
Readily admitted, and If one Could be a spec=  
tator of Such a vortex, with such defect /in it,\ as  
they call vacuum, wee Should see, all the  
matter Gravitate (as I may say) towards y<sup>e</sup>  
Extreme part's, and leav y<sup>e</sup> vacuum In the  
Midle. Hence wee may conceive, what I Shall  
affirme anon, w<sup>ch</sup> is that the tendency is  
but

but one way, call it Gravity, or levity, No matter w<sup>ch</sup>, and that is outwards; ffor If Gravity were a centrall attraction, things must goe Inwards to y<sup>e</sup> Center, contrary to a knowne Effect of Circulatory motion, that is Recess from the Center. This wee know, but y<sup>e</sup> other wee dream, as wee may any fictitious Quality wee pleas.

In cases of opposed forces, there is Nothing positive, or passive between them, so y<sup>t</sup> y<sup>e</sup> phenomenon is y<sup>e</sup> same, Suppose Either Gravity or levity to be y<sup>e</sup> positive

But they will say, If all tendency be outwards then levity is y<sup>e</sup> positive; how comes that? by all Experiments wee can make, Gravity seem's y<sup>e</sup> positive, & levity but Consequentially as one thing must give way to another. ffirst as to the Experiments, this case of Gravity and levity is one of those, w<sup>ch</sup> /that\ without fforeign help will not be distinguish't w<sup>ch</sup> is y<sup>e</sup> positive, and I may say (as of other Movements upon Impuls) the Resistance is In Neither wholly, but In both together, and y<sup>e</sup> Separation is mutuall. so the sun rising, cannot by any application of y<sup>e</sup> Sence be discovered to proceed from a motion In y<sup>e</sup> Sun or In y<sup>e</sup> Earth, ffor y<sup>e</sup> appearance Either way is Exactly the same. so for Gravity and levity, whither the Motion be of y<sup>e</sup> Matter to or from y<sup>e</sup> center it is all one In appearance, ffor some must give way, howsoever it is.

But



Argued yt y<sup>e</sup> Motive principle of Gravity is from & Not to y<sup>e</sup> Center.

That y<sup>e</sup> Matter of y<sup>e</sup> fluid world, is various & Not Carved Into any Regularity of forms or Equality of Magnitudes.

body's or part's most Globular, have Most perseverance, ceteris paribus.

But there is one way to Collect and argue that the Motive principle, is from and Not towards the center, and that is by Examining as well as wee can, the defference between the Centrall & circumferentiall Matter, as wee may observe it, In any of these vortexes. In order to w<sup>ch</sup> wee must Resume one rule that never failes, w<sup>ch</sup> is that Great body's Receiv less chang then smaller when they happen to Impell Each other, This Remembred. wee Must assume that the particles of fluid matter, and Especially at larg In y<sup>e</sup> world, as the Ether, Consist of various magnitudes & shapes. w<sup>ch</sup> will Not be denyed by those who decline cartesius /his\ Equall Globules, and ~~No thanks~~ /so wee agree\; ffor such modes of the Small are Conformable to y<sup>e</sup> Greater, w<sup>ch</sup> /wee know are more\ ~~are so~~ various, as our senses shew us; and what Els should be a sample of things Imperceptible, but things palpable, w<sup>ch</sup> are Compounded of them? and why should the Compounds be all various & Irregular, & y<sup>e</sup> Ingredients onely be manufactured Into Globes, cubes, &c. of Equall Gage. Then Next wee assume that body or part's, that come neerer to Globular figure the other's /ceteris paribus<sup>58</sup>\, have More perseverance, and less Impediment as was proved. so also of all formes, y<sup>e</sup> largest bodys

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<sup>58</sup> i.e., 'other things being equal', from Latin

Like of the greater Magnitudes.

When y<sup>e</sup> whole is In giration y<sup>e</sup> more powerfull to Reced detrude y<sup>e</sup> less towards y<sup>e</sup> center, w<sup>ch</sup> latter is called Gravity.

This disparity of force, hath no symptome to us but this distinction of Gravity & levity.

body's or parts have More force to proceed then other of less Quantity. The Consequence of all this is, that In such an agitation of y<sup>e</sup> fluid parts, the whole being In circular motion; shall produce a /sort of ferment or\ Separation of the matter; that is, the part's that have Most force to persevere In directum, shall goe from y<sup>e</sup> Center of y<sup>e</sup> Motion; and those of less power to persevere, shall be detruded towards the center. and wee are pleased to call the latter heavy, and y<sup>e</sup> other light. So here is a clear account of an universall action, w<sup>ch</sup> Must produce some universall Effect, and what In Nature Can be Charged with it but Gravity & levity. That this Centrall Recess is reall, y<sup>e</sup> patrons of attraction admitt, and consequently It must be found to operate in such rolling systemes as y<sup>e</sup> celestiall vortexes are; and is it lost to us? No Symptome to be found of So Great and generall force? I am sure If wee doe Not allow the appearance made by It In Gravity & levity, It is absconded and as to us, annihilated. therefore I must Contend that these 2. part's of the talley, centrall Recess, & Gravity & levity, that wee know are reall, & have No other fellows, being compared and fitting Each other, as I thinck Exactly must be pairs, & put together Make one Stick.

But

obj. diver's cases  
Insolvable.

1. The most solid  
Matter, is heavy  
w<sup>ch</sup>, by this hip.  
should  
be light, as of More  
force.

ans<sup>r</sup>. petitio prin=  
cipii.<sup>59</sup> for here so=  
lidity is argued from  
gravity &c.  
All matter is so=  
lid alike, the diffe=  
rence is onely in  
more or less su=  
perfacies, to that  
solidity. w<sup>ch</sup> Creates  
less or more perse=  
verance.

Ether transparent  
& Not apt to Co=  
agulate, w<sup>ch</sup> ar=  
gues, larg & Com=  
pact parts.

But Many say, this hypothesis will Not doe,  
ffor many cases are Irresolvable by it, and  
urg objections.

1. That the least solid matter is light, and  
by our hypothesis, It should be ye Most solid, y<sup>t</sup>  
by perseverance In motion gaine place out=  
wards. And the most solid as Gold, Mercury &c. doe  
most press Inwards towards ye Centers Now as to  
more or less solid, I deny ye Major. ffor I affirme  
the air or water to be as solid as Gold or Mer=  
cury. and Gold may be as readily be crowd  
Into less space as water. And this objection beggs  
the Question; ffor it argues solidity from Gravity,  
and the very distinction of More & less solid is  
denyed, for all matter is solid alike. as a  
leaf of Gold is as Solid, as a Granule, of the Same  
Content. but yet ye Granule Shall fall, when ye  
leaf is borne away by ye air. So part's of Matter  
are Not less solid ffor any shape; but Since  
perseverance in Motion is found to be as the  
Substance, and Impediment as the Superfacies,  
body's of most substance and less Impedim<sup>t</sup>  
must p<sup>r</sup>vaile others of less.

I shall take occasion from this objection to  
shew that the matter as seperated by Gravity  
& levity, Exactly answer's to the ~~most~~ & /more\ least /  
less\  
& more perseverance In Motion. I Might first  
shew it In the Ether, but that being a body  
out

---

<sup>59</sup> i.e., 'assuming the initil point' (i.e., 'begging the question', that the argument is circular)

neer centers, y<sup>e</sup>  
 matter clotts, to=  
 gether, is Small  
 & so apt to fire.  
 w<sup>ch</sup> are Stuff of  
 less perseverance.

out of our Reach to Examine, Wee can say  
 litle, but this may be observed, that it is the  
 most transparent body wee know, and from  
 thence Inferr, it Consists off y<sup>e</sup> larger parts and  
 of Such shapes, as have widest ~~Inter~~ Interstices,  
 that is towards Globular, Els light Could Not so  
 Easily pass thro it as wee perceive it doth. and  
 then it is least apt to Coagulate Into lumps,  
 w<sup>ch</sup> Shews the part's are Not Much spread. But  
 on y<sup>e</sup> other side, the token's In the matter about  
 centers, are very significative. ffor first they are  
 apt to clott together In lumps, Such as the Com=  
 mon body's about y<sup>e</sup> Earth shew, & y<sup>e</sup> Maculae on  
 y<sup>e</sup> Sun's face; w<sup>ch</sup> shew's they are of figures Exten=  
 ded & spread, & consequently of less force; and  
 also they are very apt for fire, and are In  
 great measure meer fire, as wee may Justly Sup=  
 pose y<sup>e</sup> Sun, & fixt starrs to be; And that shews y<sup>e</sup>  
 part's are very small, for such onely take Ra=  
 pid motion; as may be Shewed more fully, In the  
 Essay of fire. so that upon y<sup>e</sup> whole, wee con=  
 clude that In the centers of the vortexes, are  
 ffound matter, w<sup>ch</sup> by clotting together, & be=  
 ing Combustible, are have less perseverance in  
 the strict Cours, and so are crowded downe by  
 other's y<sup>t</sup> have more; w<sup>ch</sup> difference consists Not  
 In solidity, but In magnititude & shape of y<sup>e</sup>  
 parts.

this seperation  
is shewed by Com=  
mon practis, as  
fanning Corn, &c.

In vortication's  
of water, straw's  
&c, get into y<sup>e</sup>  
midle.

no reason to lay  
aside so real an  
action, for fancy.

This effect of motion In body's of divers  
forces comixt together, is demonstrated by Many  
familiar Experiments, & particularly ffan=  
ning of corne; w<sup>ch</sup> is done by shaking & Rolling  
y<sup>e</sup> Graine in a long fann or Sive, and the chaff  
riseth, & gather's together In y<sup>e</sup> midle of the  
upper surface of y<sup>e</sup> parcell; there is the centri=  
petall vertue. And /If wee Inter=\=Mix thing's as chaff  
and  
corne, light & heavy together, & put them  
In a rapid arcuate motion, together with  
a shaking of y<sup>e</sup> mass, /to\ be in some degree, as  
fluidity, whereby y<sup>e</sup> part's may sever and  
conforme to y<sup>e</sup> tendency of y<sup>e</sup> force, and without  
fail the lighter will Get aloft and In y<sup>e</sup> Midst,  
so In vortication's of water, all straws and  
dust get Into y<sup>e</sup> midle. ffor the perseverance  
of the heavyer is more then that of the ligh  
ter, and so In y<sup>e</sup> heaven's, If y<sup>e</sup> Matter is of  
unequall perseverance, the one Shall gaine  
Ground on y<sup>e</sup> other accordingly. why then  
Should folks goe from So plaine, and neces=  
sary Consequence of Motion in y<sup>e</sup> world, ffor  
a Caus of such segregation of matter, as is  
made by light & heavy amongst us; And take  
up with a notion of power's, of w<sup>ch</sup> No Me=  
chanisme is knowne, and argue Conse=  
quences, per Ignotiora?<sup>60</sup>

---

<sup>60</sup> i.e., 'by the (more) unknown'; a contraction of the phrase 'ignotium per ignotius', i.e., (e.g., explaining) 'the unknown by unknown', i.e., wilful mystification.

An acc<sup>o</sup> of S<sup>r</sup> Is  
N<sup>s</sup>. solution of  
Gravity by at=  
traction

No occasion for  
a centripetall  
vertue In Matter.

Admitt force of  
Recess in toto is  
according to Quan=  
tity. yet among  
y<sup>e</sup> singulars', of  
one by mean's of  
more or less Super=  
ficies for their  
Quantity  
have more force it  
must p<sup>r</sup>vail.

S<sup>r</sup>. Is Newtons Concept is that all matter is  
heavy according to the Quantity if it. ffor bo=  
dy's draw one and other more & less as the  
Quantity's. therefore Gold hath more /in\ Quantity  
then water; and water more then wood.  
and the voids are made up with vacuum. he  
say's that an inch of air If full, is as so=  
lid as an Inch of gold; and In that he is right.  
but that w<sup>ch</sup> makes air yeild, & be So light  
is the thinness, and ~~gold~~ gold so heavy is  
the density. and thinness & density are dis=  
tinguished by more & less vacuity Intersperst,  
w<sup>ch</sup> produceth the advantage one hath over  
the other In discending, as so Much more  
obnoxious to y<sup>e</sup> Centripetall Call. What occa=  
~~thing~~ sion there is for all this Imagination, I  
doe Not see; [---?] ffor wee allow all his den=  
sity's and raritys, but not his vacuums. and doe  
not charg the /variety of\ recess from the center, upon  
meer Quantity; as /ffor it is certein\ that more Substance  
must  
have More force of Recess; but /this is\ In toto,<sup>61</sup> and Not  
secundum particularia.<sup>62</sup> ffor considering, as  
wee have done, Every part Striving with its  
owne Strength /against others\ and ~~that proving~~ /their  
force of Recess being\ unequally  
distributed, according to Quantity ~~of the par=  
ticular particlars~~ and Expansion of ~~the~~ Su=  
perficies, wee have of Consequence Necessarily  
a separation of stronger from y<sup>e</sup> weaker, one  
receding /from\ and /consequently\ the other yeilding,  
towards y<sup>e</sup> Center.

---

<sup>61</sup> i.e., 'in all'

<sup>62</sup> i.e., 'the secondary parts'.

obj. that the  
Recess Must be  
from y<sup>e</sup> axis &  
Not from y<sup>e</sup> Center.

Difficult to know  
If gravity differ  
In polar from y<sup>e</sup>  
equinoctiall places.  
If any, least at  
y<sup>e</sup> polar;

2. Another objection, and y<sup>e</sup> cheif, is that  
If the action of Gravity, be consequent of  
levity, and that onely a more powerfull Re=  
cess from y<sup>e</sup> center. then the axis of y<sup>e</sup> world  
carry's all y<sup>e</sup> center's, and the levity must  
be a tendency from that point of y<sup>e</sup> axis, w<sup>ch</sup>  
is Centrall to its motion; and so the Gravity  
must Not be by perpendicular's to the ho=  
rison, but to the axis, y<sup>e</sup> Contrary of w<sup>ch</sup> is  
ffound true. All this I must admitt, If the case  
were of any Single body, tyed to y<sup>e</sup> axis of  
y<sup>e</sup> world in a string, and then Rolled about,  
the String would be perpendicular to the  
axis; But the matter In Question is ffarr other=  
wise; ffor the Resolution of w<sup>ch</sup>. I shall Con=  
sider the center-Globe, Respecting /1.\ the  
Equinoctiall Regions, &. 2. the polar Re=  
gion's. Whither Gravity be more or less  
In either of these then in y<sup>e</sup> other is hard  
to know, becaus the distance of the Extremes  
is to great for a Comparison to be made;  
and If any difference be the less, is In the  
polar region's, and y<sup>e</sup> Greatest at y<sup>e</sup> Equator.  
and the declension of y<sup>e</sup> force to y<sup>e</sup> pole is  
Graduall; and all weight's or experim<sup>ts</sup>  
made in one place & translated to y<sup>e</sup> other,  
transferr's also the alteration, as well to  
y<sup>e</sup> Register as y<sup>e</sup> weight, & so Enervates all  
tryall, but I may say my opinion is there  
is

The whole vortex of y<sup>e</sup> Earth is so vast, compared with y<sup>e</sup> Globe at y<sup>e</sup> center, that matter is detrued downe to all parts neer Indifferently.

<diagram>

Matter Coming to y<sup>e</sup> center from any part, as y<sup>e</sup> Region's of y<sup>e</sup> axis makes room for all the Rest to pass. and If any Movement in a pressing fluid gives way, it shall be so made.

is some, but very little, If any difference. for all the stronger matter get's to the Exterior part's, and the weaker is detrued towards the center of the whole, without Much Regard to y<sup>e</sup> Axis. for we must Remember, that If any Matter by moving shall make way to a body Movent, that Shall move, however slow. And If heavy matter, be about y<sup>e</sup> pole of the vortex, Comes neerer the center, there is More room for the lighter matter to be disposed at greater distance from y<sup>e</sup> Center. let a. & b. be y<sup>e</sup> poles. the strongest Recess is about c. d. & f. e. and If the matter at g. & h. goes in towards b. then there is room made for that at c. & e. to goe towards d. & f. and for that reason, the Matter that is weak shall yeild at a. & b.

Again, to demonstrate that the polar matter gives way, as well as In other places. let the Globe. e. k. c. i. be a shell, and in it onely vacuity. let y<sup>e</sup> pole. l. be a foramen. None can say but, the Equinoctiall matter shall detrued the polar matter, In at that place. but to confirme this more. let us examine the pressure of fluids; If one part be higher then another, It shall press the rest, If there be No other way, directly upright. As if  
you



<diagram>

you take a vessel with a vent pipe at the bottom, conducted to the height of an hous and a force is applyed to y<sup>e</sup> Water, It shall drive the water up & make it flow from y<sup>e</sup> highest part. and yet the force give's No direction but downewards. so In the vortex the matter preseth outwards, drives that w<sup>ch</sup> hath Not force to Resist Into any place where it Can pass, that is from y<sup>e</sup> poles of y<sup>e</sup> vortex towards y<sup>e</sup> center, & Into it If there were room.

If a void were In y<sup>e</sup> vortex, it would be Globular at y<sup>e</sup> center, & Not as a batoon at y<sup>e</sup> axis.

But admitt what the objection Say's, that the pressure is to & from y<sup>e</sup> Axis, & Not from y<sup>e</sup> Center. I would ask If there were a vacu=um of about 1/20<sup>th</sup>. of the vortex. would that Make an oblong void like a batoon, In the part's of y<sup>e</sup> axis, or /In forme of\ a Globe at y<sup>e</sup> center? I beleev, for y<sup>e</sup> reason given, they would owne that the matter would be Crowded Into this batoon-void, till y<sup>e</sup> vacuity became Globular or Near it. If I may Give my [~~sence~~] opinion, y<sup>e</sup> forme would be rather oval, and some thinck y<sup>e</sup> Earth it self is so, y<sup>e</sup> axis being y<sup>e</sup> longest di=ameter. /but\ this is by y<sup>e</sup> way onely. that w<sup>ch</sup> I Contend for is, that the pressure out-wards at the Equinoctiall Regions, crouds y<sup>e</sup> yeelding Mat=ter, as well from y<sup>e</sup> pole, as from other parts of y<sup>e</sup> vortex towards y<sup>e</sup> Center. W<sup>ch</sup> will Not be thought Strang to such as consider that fluids prest run Into all corners, so favour yeelding

The vast Extent  
whence part's  
derive y<sup>e</sup> Influence  
y<sup>t</sup> makes them hea=  
vy. And there Can  
be no minute acc<sup>o</sup>  
of any Such In=  
fluence, but onely  
of y<sup>e</sup> Event In Gross  
by y<sup>e</sup> consequent  
Gravity.

That direction  
of Gravity, that  
Most open's y<sup>e</sup>  
way the force  
urgeth Shall take  
place; as In other  
cases of pressure.  
Hence Gravity is by y<sup>e</sup>  
perpendicular.

These are y<sup>e</sup> two cheif objections against this  
Hypothesis of Gravity; In ans<sup>r</sup> to w<sup>ch</sup> I have pro=  
duced some thing's I had to say of y<sup>e</sup> Subject, but  
much more Remaines; and truely Nature hath Not  
a More considerable phenomenon. It is a most  
Intricate Imagination, To Conceiv how this effect  
of Gravity, is Mechanically brought about. Iff wee /might\  
take ~~the least~~ /a small\ particle of matter, ~~that~~ /  
w<sup>ch</sup>\tends downe=  
wards, and trace the Impulses from part to part,  
w<sup>ch</sup> produce that tendency, the path's would be  
both Immen's & Innumerable, as the part's of  
Matter in (at least,) an whole hemisphear of  
the vortex is; I mean such as are Superior in  
perseverance of Motion, ffor Every other that hath  
any degree of Inferiority, In Such perseverance,  
So take a solid Compact body, the pulses upon  
that w<sup>ch</sup> drive it downwards, are No less un=  
accountable. as also when they Strike, Either  
upon y<sup>e</sup> Exterior, Interior parts, or both; So that  
wee can have No account of y<sup>e</sup> Matter but  
In Sume, or Gross Event. And what should that  
be, but this: that w<sup>ch</sup> way Moving, Shall make  
the speediest way cours from y<sup>e</sup> force, that is to  
lett y<sup>e</sup> force pass, with most advantage; and that  
will be the direction of the heavy body. W<sup>ch</sup> is  
according to our mechanick Canon, that what  
~~Giving-way~~ by moving will make any way  
shall.

Note.

It is a fals rule y<sup>e</sup> body's tend In a tangent; for they tend by y<sup>e</sup> rule of Impuls, as the direction happens, so y<sup>e</sup> Recess of a part In a paralell, drives Matter as well towards y<sup>e</sup> Equator & pole, as normally from y<sup>e</sup> axis.

<sup>q</sup><sup>63</sup> Experiment of light body's In a florence flask turned If Not Come to y<sup>e</sup> Equator. The planets are all about y<sup>e</sup> Equator. w<sup>ch</sup> shews that even polar matter tends towards y<sup>e</sup> Equator by Recess &c.

<accidental? line>

Experiment's by shaking & at same time turning body of different Consistencys.

Shall Move; and If there be No Restraint that way, as makes most room for y<sup>e</sup> force. then the sume, or gross Event of centrall Recess is to depart in right lines or Rays from y<sup>e</sup> Center, and Consequently y<sup>e</sup> Sume or Gross Event of Gravity, w<sup>ch</sup> is y<sup>e</sup> other Scale, is to Move directly towards y<sup>e</sup> Center, that is, by y<sup>e</sup> perpendicular.

This Case of gravity is capable of being Experimented, by fluids put in open vessells; & turned round; the Crowding outwards, will visibly appear, by the liquor dishing up at the Sides, & hollowing In y<sup>e</sup> Midle. And If any straws or light stuff be Intermixt, it will certainly assemble there. This is Enough to shew y<sup>e</sup> Gross Event in such cases; tho the mechanisme is not Intelligible, wee may be assured there is Suc[h?] as that one boul striking another makes it run[.?] But farther, let us Conceiv a Mass of Matter Consisting of stones, some larg & round, others Small, and also long & spread out. let these be agitated /Intestinely\ as fluids are, and y<sup>e</sup> Mass be turned round as y<sup>e</sup> water in a vessell. wee must needs conceiv that y<sup>e</sup> larg & sound, will be shaken outwards, and the other sort Gather neerer y<sup>e</sup> Center. So much will Imaginary Enlargement of thing's, give a seeming Inspection; & Guide our Judgm't; ffor wee readily take a true Notion of Events In great body's we[e?] most Convers with; and know Not w<sup>t</sup> to thinck of Small ones<sup>64</sup>

<sup>63</sup> RN uses this abbreviation, a lower-case 'q' with an indeterminable superscript letter (which I read as 'a') a number of times throughout the MSS. I read them as the abbreviation for 'quia', meaning 'because' or 'wherefore'

<sup>64</sup> Note crowding at bottom of page.

The End of Gra=  
vity is when all  
matter is shuffled  
Into such distance  
as that their force  
is ballanc't & there  
they rest.

The sentence, Nill  
Gravitat in suo  
loco,<sup>65</sup> true, as to  
all particulars  
but Not, in Masses.

But what is the End of this separatory ac=  
tion of the vorticall matter? ffor it is Not per=  
petuall. I make No doubdt but when the  
matter of different perseverances, are disposed  
In places or sortment's of Each together, at  
certein distances from y<sup>e</sup> Center, In w<sup>ch</sup> they are  
of Equall force one ag<sup>t</sup> another, and all neerer  
have less force, and all ~~more~~ farther off More,  
Such part's Rest there, And are, In y<sup>e</sup> Comon  
sence, ballanc't. That is If a cubick ffoot of  
the aeiriall. fluid, just as it is, with all the  
Interstitiall matter, were removed to any  
remoter, or neerer distance from y<sup>e</sup> center,  
and there set free, It would soon disper's, and  
be reduced, thro various agitation's, & mean=  
der's, to its orb againe, or Into Some Mixture,  
where it may be ballanced, as it was before.  
But let this portion of fluid become a solid, then  
considering y<sup>e</sup> whole, it hath Either more or  
less perseverance in motion, then the Quanti=  
ty of Space In y<sup>e</sup> Ether, it is Removed into. and  
If more, then it is light, ffor that perseverance  
will p<sup>r</sup>vaile, till it is In a place or orb, where  
like space, hath like force, and If less, then  
It must yeild, that is be heavy, and descend  
till It finds a ballance. Such is found the  
rule

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<sup>65</sup> i.e., 'nothing has gravity in its own place', an Aristotelian maxim suggesting that gravity affects something not in its proper place, as it moves towards its proper place.

obj. from y<sup>e</sup> great  
power of Gravity.  
ans<sup>r</sup>. greatness is  
comparative, If y<sup>e</sup>  
excess of one power  
over another be  
great, much y<sup>t</sup>  
power is, Great,  
tho for Same rea=  
son, little with Res=  
pect to another

Arging from great=  
ness, is in a Circle

rule in hydrostaticks, of w<sup>ch</sup> y<sup>e</sup> reason May be  
to Conceiv or Collate, the Innumerable Inllu=  
ences of the Etheriall Matter from Even beyond  
Saturne, upon Every small corpuscle neer as  
so as to understand the cours of Gravity &  
levity to be the consequence of it; But If such  
universall tendency outwards, be admitted,  
with y<sup>e</sup> aeriall fluidity, It cannot be otherwise  
They will say, how can that produce such Im=  
men's force as y<sup>e</sup> weight of a Cubick ffoot of  
Gold, lead, or Mecury? I ans<sup>r</sup>, how doe they  
know that weight is of such vast force? they  
Replye. 3. men Cannot lift it. Then I add  
how comes the strength of 3. men to be so  
vast, they Returne, becaus they can lift so  
much weight. so here is a circle. Wee Judg of  
weight by our owne strength, and of our owne  
strength by weight, and wonder at both.  
Whereas there is Nothing Extraordinary In Ei=  
ther; ffor If wee are weak, wee thinck the  
weight Great. So that our account of force,  
is as it is of all magnitudes, by comparison  
with

with our selves. therefore I must say of force as I say'd of Magnitude, w<sup>ch</sup>—~~is~~ that Comparison abstracted, all are alike. ffor if fforce, as a particle of Matter, be any thing, it is more or less, as greater, or Smaller, as the comparison Make's it. therefore our opinion of Magitude or Strength, is No argument for or against any thing. And here in this case of Gravity, If thing's are determined to move /at all\ there are degrees of More, and less, as circum=stances of y<sup>e</sup> force, & Resistance Require; /and\ as our strength happen's to be comparable so wee thinck, and, as occasion is, admire.

What tendency  
or Conatus ad  
Motum Means,  
vis<sup>t</sup>. onely ceas=  
less impulses of  
small matter u=  
pon very great  
In y<sup>e</sup> Same direction.

It May and doth often happen, that body's are taken in to place above y<sup>e</sup> Sphear or orb of their ballance, and then they are heavy, that is press downewards, and yet be /are\ obstructed by Some Impediment of Superior force, So as they Cannot Move; then ffollows a tendency or continuall conatus ad Motum,<sup>66</sup> w<sup>ch</sup> is Nothing but Incessant strokes of y<sup>e</sup> Whole hemisphere of Ether upon it, w<sup>ch</sup> at y<sup>e</sup> moment of liberty either In whole or In part, & move y<sup>e</sup> body accordingly. This is the Case of our comon terrene body's, w<sup>ch</sup> continually press downe=wards, but how ffar they are to move to [Come?] Into a ballance, wee know Not, & have No Mean's to Experiment. And It is No wonder that there

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<sup>66</sup> The meaning ('impulse to move') is clear here. This is an Aristotelian/scholastic term (implying an anthropomorphic 'kindly inclining') that was redeployed in the New Philosophy, and especially by Descartes. RN is here focussing upon a mechanistic and therefore materialistic explanation of movement and its cause.

The centrall pla=  
net, is collected  
out of all y<sup>e</sup> vor=  
tex, by gravity  
seperating it

fluids, when de=  
fecated, shew No  
pressure, becaus  
y<sup>e</sup> part's unifor=  
mly mixt Sustein  
Each other In  
Ballance.

but a vent Made  
y<sup>e</sup> Whole fluid hath  
pressure appearing  
there.

Gravity a Most  
Naturall Soluti=  
on of the station  
& libration of y<sup>e</sup>  
planets.

there is a hudle & crowding of the Matter  
neer y<sup>e</sup> center, ffor it is severed from y<sup>e</sup> Rest  
by y<sup>e</sup> action of Gravity, & levity out of the  
whole Sphear or vortex; And the Event Shews  
that there is very Much w<sup>ch</sup> will Not find a  
ballance, at y<sup>e</sup> /any\ distance wee know from the  
center; and S<sup>e</sup> lodges one part upon another  
neer to y<sup>e</sup> Center, & fills up y<sup>e</sup> Space, and So /y<sup>e</sup>  
Inferior\

Sustains y<sup>e</sup> force of y<sup>e</sup> Superior parts, and all  
the weight of y<sup>e</sup> fluid air or Ether upon it w<sup>ch</sup>  
would descend also, If there were room. And  
Such fluids as wee take air and liquor to be,  
they are of a materiall w<sup>ch</sup> is uniformly  
mixed; and so litle separation is made In them,  
except what happen's by fermentation, and  
adventitious heterogene Mixture, as Smoak  
[dust?] or y<sup>e</sup> like; but such press in y<sup>e</sup> fluid State  
without settling out of it, or Subsiding of y<sup>e</sup>  
parts/w<sup>ch</sup> remaine In ballance ag<sup>t</sup> each other\ But  
wheresoever way is made for /any\ p<sup>t</sup>  
to pass, then y<sup>e</sup> pressure is discerned, by a Mo=  
tion Into it.

I have touched two sorts of body's upon w<sup>ch</sup>  
Gravity acts, 1. solids, 2. fluids. as to y<sup>e</sup> for=  
mer, I must appeal to what hath bin alled=  
ged, whither y<sup>e</sup> state of y<sup>e</sup> planetts can have  
a more familiar, and Naturall solution, for  
their orbicular movements, then here hath  
bin

S<sup>r</sup>. I. N<sup>s</sup>. expe=  
rim<sup>ts</sup>, Not Contra=  
dict this solution.

error is, that  
Gravity is calcu=  
lated by Quan=  
tity out of substance  
In generall; when  
it Should be accor=  
ding to Magnitude  
& shape of par=  
ticulars.

The differences  
of Gravitating  
Matter

bin Represented, or If any other, is Corporate  
with it. I know it is a great aim of S<sup>r</sup>. Is. N.  
to disable it, who puts forth Experiments, w<sup>ch</sup>  
y<sup>e</sup> Same Stuff descend & accelerate with Equall  
celerity. as 1. lb. of lead, an 1. oz. let fall from an  
high tower, & each comes to y<sup>e</sup> Ground together.  
w<sup>ch</sup> is Contrary to y<sup>e</sup> opinion of y<sup>e</sup> ancients. W<sup>ch</sup> May  
be true, with allowance of y<sup>e</sup> friction of y<sup>e</sup> air,  
ffor that in small magnitudes, doth almost E=  
nervate Gravity; as with y<sup>e</sup> Reason's hath bin shewed.  
The Error of this whole affair is, that some have  
taken y<sup>e</sup> force of Gravity to be as more or less  
substance. Whereas in truth it is, more or less  
perseverance of force, w<sup>ch</sup> vary's by superfi=  
cies, & magnitude of part's, as well as /y<sup>e</sup> totall\  
Measure  
of aggregated bodys. ffor If part's are more ob=  
noxious to Impediments then other's are, how=  
ever close compact, the property of yeilding  
is Not taken away, becaus y<sup>e</sup> Subtile matter, by  
w<sup>ch</sup> y<sup>e</sup> force is /partly\  
Conveyed, as well as by y<sup>e</sup>  
~~Grosser,~~  
penetrates amongst them; so Gold hath More of  
(Gravitating) substance then water.

As to this matter, wee may Reflect of on y<sup>e</sup>  
condition of Gravitating matter, and y<sup>e</sup> diffe=  
rences as may happen in it. w<sup>ch</sup> are No  
other then may, be drawne from our  
former



Those differences  
Shewed resultable  
from particular  
magnitudes &  
Shapes.

former supposall of the irregularity and Inequality of materiall parts. ffor If out of that there happen, as many causes, accidentally may produce, segregation's or sortments, of part's in different Condition there Must needs ffollow, a different measure of Gravity; and this whither y<sup>e</sup> Mass be solid of fluid. As If wee have some part's as big as millstones, or Great pieces of Rocks, other's as comon pebble, or Rubble stone. other's as Shingle, & then sand, & so on. w<sup>ch</sup> may be Intermixt & move together continually Interfering. And of these some, may be expanded In length other's in breadth; some Globular others cubick or oblong, so pointed, smooth, &c. And sortment's are made of these, as ffor Instance, of some that may Resemble ~~thin plat~~ comon Dyce, or /some what\ drawne out In length but as much smaller then y<sup>e</sup> part's of wood or water, as the shingle is less then Millstones. It must of necessity be heavyer, then an equally-circumscribed parcell of Millstones. ffor those have by largeness have more force of lightness; and wherever this matter Comes It will be found with that difference, In y<sup>e</sup> weight, as w<sup>ch</sup> may Suppose In the parts as hath bin hinted.

next

obj.  
The measure of  
Imprest force see=  
mes to be gui=  
ded by Gravity  
& Not bulk. ffor  
light things have  
less force then heavy.

ans<sup>r</sup>.  
Things are More  
or less compact  
as heavyer or  
lighter. for the  
Smallest Matter  
ly's closest and y<sup>e</sup>  
being Spread Into  
plates, is still more  
close.

Next It may be sayd, that wee find by y<sup>e</sup>  
force of a body moving, called y<sup>e</sup> vis Impressa  
w<sup>ch</sup> is more, or less powerfull, according to  
y<sup>e</sup> Quantity of it; that heavy body's have  
a vis Impressa ad Modum Quantitatis  
Et Gravitatis.<sup>67</sup> and on y<sup>e</sup> Contrary, body's light  
fail, being of weaker force according to  
the lightness. w<sup>ch</sup> argues that weight and  
lightness is by more & less substances, & Not  
forme or shape. In ans<sup>r</sup> to this, wee must Con=  
sider that In y<sup>e</sup> Same circumscribed Space  
there may be more or less Gravitating Matter  
or at least In greater or less degree, but If wee  
take y<sup>e</sup> matter y<sup>t</sup> fill's all y<sup>e</sup> Circumscribed  
space into y<sup>e</sup> acc<sup>o</sup>, force will be as y<sup>e</sup>  
space, that is Quantity. But If a space, as  
a bushell be filled with Great Irregular Stones  
the Interstices are It may be one half /of y<sup>e</sup> space\ or  
more, If filled with smaller stones, less, &  
/there may be much more sustance, w<sup>ch</sup> may be y<sup>e</sup> Case of  
Gold, &c.\  
And what Matter is In y<sup>e</sup> Interstices, being No  
part of y<sup>e</sup> Continuum but of y<sup>e</sup> Medium, is  
not brought to y<sup>e</sup> acc<sup>o</sup> of y<sup>e</sup> substance. ffor  
this reason, Great bodys /and Irregular\ parts, compose  
Not  
onely body's that are lighter but also of  
less force. as ffor Instance wood. that is found  
to be but a bundle of pipes. why should  
that

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<sup>67</sup> i.e., 'an impressed force in a measurable form of weight'.

This is seen In the  
Extreem's; as on y<sup>e</sup>  
one side feathers,  
& on y<sup>e</sup> other Mettals,  
w<sup>ch</sup> May be Made as  
light as feather's,  
such is leaf Gold.

Exp.  
Gold & Silver Mel=  
ted together, In  
aqua Rs.<sup>68</sup> y<sup>e</sup> silver  
shall be pick't out  
& y<sup>e</sup> Gold remain in  
same forme to y<sup>e</sup>  
Eye but lighter. so  
of other things.

The comparison  
of Gravity is ge=  
nerally ag<sup>t</sup> y<sup>e</sup> fluid  
In w<sup>ch</sup> body's Move  
for In some they  
are heavy In others  
light

that have so Much force, as If the same [Were?]  
run or fluxed all-together, and Even then  
the difference of Magnitude, & forme of the  
part's, May yet make it lighter and of  
less force then Mettalls. As for Instance  
Glass, made of Ashes, w<sup>ch</sup> is y<sup>e</sup> Grosser part  
of wood, Inept to move, is not so heavy as Gold  
or mercury. being ffull of Interstices, y<sup>e</sup> matter  
Included, not adding to y<sup>e</sup> Imprest force of y<sup>e</sup>  
Glass, becaus ready alwais to start forth; of  
w<sup>ch</sup> more Elsewhere.

Another thing is considerable, that it is Not  
a comparison of one body ag<sup>t</sup> another, as of E=  
very thing with y<sup>e</sup> fluid In w<sup>ch</sup> it is capable to  
move. ffor some thing's that were heavy in  
y<sup>e</sup> air become light In water, as wood, Cork,  
& many things wee handle. And so water  
In our view, performes that, w<sup>ch</sup> is done In y<sup>e</sup>  
Ether it self; In this case of water we p<sup>sup</sup>=  
pose a principall of Gravity, but It Resides  
In y<sup>e</sup> Ether, and the water it self is subjec[t]  
and plac't by it, as severed from things ligh[=]  
ter.

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<sup>68</sup> Aqua Regia ('royal water', so called for its ability to dissolve the 'noble metals') nitro-hydrochloric acid. See note on f 123v.

Ag<sup>t</sup> y<sup>e</sup> author of  
y<sup>e</sup> Non Gravitation  
of fluids.

2. Now I come to the Consider the Gravita=  
tion of fluids, w<sup>ch</sup> is a subject that leads  
to y<sup>e</sup> knowledg of naturall causes, as much  
as any; and one would thinck of as much  
difficulty, having seen a laborious author  
of y<sup>e</sup> Non gravitation of fluids;<sup>69</sup> who suppo=  
seth and would prove, that a fluid creates  
No pressure upon any solid Immerst In it.  
Some Not used to Contradiction thinck all  
their fancy's to be law; what ever was  
put In print more Contrary to truth? ffor there  
is Not a grain of a fluid w<sup>ch</sup> hath Not its  
weight, & presseth in y<sup>e</sup> Inferior part's, and  
all thing's Residing In them; W<sup>ch</sup> to Make  
More Intelligible, I must Goe abroad, & take  
a view of the whole solar systeme.

All sayd of y<sup>e</sup>  
Grand vortex of y<sup>e</sup>  
Sun applicable  
to all y<sup>e</sup> Subvor=  
texes of y<sup>e</sup> planets.

I have hitherto Expressed, as thincking onely  
of y<sup>e</sup> Grand vortex of y<sup>e</sup> Sun, but what is sayd  
of that, is applicable to Every Subvortex, as  
that about y<sup>e</sup> Earth, w<sup>ch</sup> Cary's y<sup>e</sup> M[oon?]/oon\ &  
others about Saturne, & Jupiter; W<sup>ch</sup> Carry's  
their Satellites or Moons. the same consequ=  
quences attend all alike. onely with this dif=  
ference, that y<sup>e</sup> Centrall matter of y<sup>e</sup> Sun is  
probably Not onely very Small but apt to  
motion.

The Sun aptest to  
fire, becaus y<sup>e</sup> other  
plannets, are ga=  
thered of a matter  
farther from y<sup>e</sup>  
Center.  
& so less apt to fire.

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<sup>69</sup> Sir Matthew Hale (1609-76), *An essay touching the gravitation, or non-gravitation of fluid bodies, and the reasons thereof*, London, Printed by W. Godbid for William Shrewsbury, 1673. Sir Matthew Hale was an important lawyer, historian of and theorist of law, and was Chief Justice during Francis North's rise to eminence. He was personally known to RN and features in *Notes of Me*. RN frequently makes spiteful reference to (what he calls) Hales' low, puritan, republican sentiments, and to his efforts as an amateur scientist.

The finess of y<sup>e</sup>  
Matter of planets  
& what attends  
them, is according  
to their distance  
from thei<sup>r</sup> Centers.  
or sun.

Not Necessary y<sup>t</sup>  
y<sup>e</sup> Center of y<sup>e</sup> Earth  
be actuall fire, tho  
more apt to it then  
y<sup>e</sup> Circumferentiall  
Matter

motion, whereas y<sup>e</sup> centrall matter of the In=  
ferior or subvortexes, may be small, but Not  
to that degree, nor so apt to Move; all w<sup>ch</sup>  
are y<sup>e</sup> Consequences of Magnitude and figure,  
w<sup>ch</sup> wee Cannot Examine Into. But If wee  
are allowed to Estimate Such Matters, I thinck  
there is Reason the matter of y<sup>e</sup> Sun should be  
finer, then that of y<sup>e</sup> planets; becaus the pla=  
nets being placed at such distances as they  
are with their vortexes; they being taken all  
together as to [turn's?], or as bladder's In y<sup>e</sup> air,  
have a just force of perseverance in direction  
as the Ether of like Content, hath in that  
same orb. Therefore Mercury Next y<sup>e</sup> Sun  
is of y<sup>e</sup> finest Composition, then venus, then  
y<sup>e</sup> Earth, mars, Jupiter, & saturne. the Comon  
fineness of thing's with us, is that of water  
& Comon Earth, or Stones; w<sup>ch</sup> differ Not Much  
probably neerer the center of y<sup>e</sup> Matter May be  
yet finer, If Not In Some measure as solar  
fire, but mettall's, wee know, are finer then  
earth; and So heavyer; but those are collec=  
lected accidentally from other matter, /by reason of \ from  
certein shapes of ~~y<sup>e</sup> matter~~ & action's wee doe  
Not /yet\ understand. and altho the earth May  
have much of combustible matter towards  
y<sup>e</sup> center, I doe Not thinck it should be all  
fire

Gross body's with  
[..?] at y<sup>e</sup> Sun would  
be fire.

planet's, less hot  
from their owne  
Constitution as  
well as by distance  
from y<sup>e</sup> Sun.

Note  
y<sup>e</sup> advantage y<sup>t</sup>  
Jupiter hath by 4  
moons, & Sature  
5. & a Ring.

like y<sup>e</sup> body of y<sup>e</sup> Sun, but More combusti=  
ble, then at y<sup>e</sup> surface, and not capable to  
break out ffor want of air, yet at y<sup>e</sup> Surface  
there is much of that in some places, where  
y<sup>e</sup> volcano-Mountaines are. but probably If  
gold were in y<sup>e</sup> vortex of y<sup>e</sup> Sun, It would  
soon be there and become fire, as many  
other matter's, as /w<sup>ch</sup>\ with us is /are\  
Gross, and onely  
combustible by culinary heats, whereof  
some goe more, & others less Into vapour,  
ffor w<sup>ch</sup>, there is In the texture of them a  
sufficient reason, It were well, wee Could  
possibly know it. In y<sup>e</sup> other planet's at  
more distance y<sup>e</sup> heat is less, and at saturne  
least of all; ffor the substance of that Must  
be very Gross and persevering, to take a  
place so farr from y<sup>e</sup> Center. Here Comes In=  
to My Mind a reason that the vortexes  
of y<sup>e</sup> planet's are Not absorpt by y<sup>e</sup> Ether,  
nor at all Compres't upon. ffor the matter  
of them being neer Equall distance from  
y<sup>e</sup> Sun, is at a ballance with y<sup>e</sup> Circumam=  
bient Ether, and so free to persevere In y<sup>e</sup>  
circular motion, as thing's In ballance are  
no hindrance to Each other. but this is  
all out of my way I come to y<sup>e</sup> Nature of  
Gravity with fluids.

weight of a flu=  
id is y<sup>e</sup> Sum of y<sup>e</sup>  
weight of all y<sup>e</sup>  
parts.

liquor's specifi=  
cally heavyer /one\  
then  
each /an\ other, will  
mix or Not as the  
superiority is

fluids as hath bin say'd, are of uniforme  
mixture, ffor the perpetuall agitation of y<sup>e</sup>  
part's, make it so. If any are much lighter  
or heavyer then y<sup>e</sup> Rest and of Magnitude=  
Sufficient, as bubbles or lumps of difforme  
condition, they sepearate and rise, or fall.  
The Rest are such as are of neer Equall  
weight, and If otherwise, yet have Not  
force Enough to Separate. therefore a fluid  
hath weight in toto, as a solid, and that  
is compound of y<sup>e</sup> Weight of all y<sup>e</sup> parts.  
But the part's ag<sup>t</sup> one and other have  
No weight, as 2. pounds In scales, have  
ag<sup>t</sup> Each other, no weight; tho both press  
y<sup>e</sup> fulcrum or center of y<sup>e</sup> ballance, and (In  
proposition) the least weight moves both  
and turnes y<sup>e</sup> scales. so If there be a Cubick  
Inch of water, In any part of a vessell,  
Given. that cannot rise sink, becaus If it  
doth /sink\ another like must rise, w<sup>ch</sup> hath as  
much force as it self to sink. It May happen  
sometimes that an heavyer liquor being  
underneath, as wine /being\ under /-neath\ water, shall  
Not soon Commix, as It will If placed aloft,  
ffor then it descends and break's y<sup>e</sup> body  
letting y<sup>e</sup> air /water\ amongst it to commix with  
it but when underneath y<sup>e</sup> body is Intire  
& Not broke, and y<sup>e</sup> action of y<sup>e</sup> fluid Com=  
mixs at y<sup>e</sup> Junctures onely, & Gradually.

ffluids press so as the Inferior part's have More pressure upon them then y<sup>e</sup> superior in proportion with the height, in the gage or direction of y<sup>e</sup> pressure.

The ballance of a fluid, makes y<sup>e</sup> part's free to move any way without any Impediment from Gravity, but In y<sup>e</sup> way of friction

~~for this Reason the surface of a fluid cannot~~ Rest In every fluid whatever, In Regard it consists of a body uniformly mixt, the upper part's press the lower; And that In all degrees from the bottom of a vessell upwards. And this is No more then when stones, wood, or Comon scale-weights are piled upon one & other the lowermost bears the Rest, and shall press any thing underneath, with as much More force as the weight of them amounts too. the onely difference is, that y<sup>e</sup> part's of water are in perpetuall movement. but the effect of their Gravitation is no less, ffor If a part riseth not, the moving laterally /or\ as wee call /it\ In y<sup>e</sup> level, if /if?\

descent is not Impeded. and If a part be by y<sup>e</sup> action of another made to rise, that with Equall force at y<sup>e</sup> Same time, (w<sup>ch</sup> is y<sup>e</sup> Reaction,) strikes others downe, so as y<sup>e</sup> Result of the whole is, that all y<sup>e</sup> part's are Incumbent with their weight upon each other, but where y<sup>e</sup> tendency's are Equall y<sup>e</sup> Same way, as it is among y<sup>e</sup> part's of a fluid mass, there is No Intestine /Effectuall\ Motion /Gravity\ but an Indifference to move any way, as the Scales of an Equipoised ballance.

~~One Consequence of this is, that a solid Immerst In a fluid, can be poysed in one place onely,~~



The base or body  
on w<sup>ch</sup> a fluid Rests  
Sustein's y<sup>e</sup> whole, as  
a fulcrum to a  
ballance.

The surface of a  
fluid Must be In=  
different, y<sup>t</sup> is  
Square  
to y<sup>e</sup> direction of y<sup>e</sup>  
pressure, /or\, as wee  
say  
level.

Then It follows that every fluid is prest /by Gravity\  
more, ffrom the surface downwards, where it  
Is most prest, and the base susteins y<sup>e</sup> Whole,  
as the fulcrum of y<sup>e</sup> ballance susteins y<sup>e</sup> beam  
& its weight's. And hence Results the Con=  
sideration of a levell-plan, In Every fluid  
ffor that is the distance from y<sup>e</sup> base /surface\  
y<sup>e</sup> pressure is Equall; so as It cannot be sayd  
that ~~more of~~ the Incumbent force, from the  
action of Gravity, operates more, In one poin[t]  
of a levell plan then in another. and for y<sup>e</sup>  
same reason y<sup>e</sup> Surface of a fluid /undisturbed\  
Must be level; ffor If any part is Gibbous, and ~~riseth~~  
riseth /up that is\ against y<sup>e</sup> action of Gravity, more  
then  
the Rest; the/n the\ level plan of the surface  
hath a weight upon it there, w<sup>ch</sup> It hath  
not In other places. And the surface ~~having~~  
where y<sup>e</sup> beginning of y<sup>e</sup> pressure is, Making  
No Resistance, the advanc't part must  
sink somewhat. And If it be of y<sup>e</sup> same  
fluid till No part remain's advanc't, y<sup>t</sup>  
is till y<sup>e</sup> Surface is levell. And becaus a  
body In motion, doth Not stop unless  
Resisted by an Equall force, at one Im=  
puls, when it is Made to Move ag<sup>t</sup> a  
yeilding fluid, It will pass beyond y<sup>e</sup>  
place where the force is a Match for  
it

part's put out  
of levell, will Re=  
turne, and with vis  
Imprest goe be=  
yond y<sup>e</sup> level, &  
then Returne with  
somewhat less force  
& so on till settle  
In a level; w<sup>ch</sup>  
action is called  
waves or undula=  
tion's.

This is ffor  
[clearing?]  
the object to y<sup>e</sup>  
reason of Gravity  
becaus tendency  
is from y<sup>e</sup> axis &  
Not from y<sup>e</sup> center.

it; till it stops, & then by y<sup>e</sup> alternate force  
rise. and so make some Returnes ~~it~~ to &  
againne till it settles In Rest, or at least to  
us seem's so to doe. If this be onely [-+?] /part of\  
the same fluid, It gives us a consequent  
action of the surface, More Conspicuously  
tho solids doe the same, called undulations  
ffor the body discending, cannot put all  
the fluid Into a new levell In a Moment  
but that must Come Gradually. as In water  
If the Surface be raised up in y<sup>e</sup> Midle  
It cannot put the water at y<sup>e</sup> sides up at  
y<sup>e</sup> Same time, as it puts it up, Next it Self,  
becaus a force makes y<sup>e</sup> fluid yeild, rather  
then Move so great a mass at once; be=  
yond y<sup>e</sup> power of a small body to doe in  
y<sup>e</sup> time Required. therefore the fluid Next  
y<sup>e</sup> descending part Shall Rise, & that dis=  
cend, & other Rise, & that also, and So  
proceed in [wavives?] Moving as from a cen=  
ter, then w<sup>ch</sup> Nothing is More Notorious.

Here it Comes Into My Mind to observe  
how force In fluids created from or towards  
any point will act orbicularly. w<sup>ch</sup> is from  
the dispersion of the force according to Me=  
chanicall direction of the part's by w<sup>ch</sup> /Impelling  
e/E\very way, as Iregularity & figure leads, the  
Result

Result of  $w^{ch}$  is in orbe. as the tendency of ~~some~~ body's from y<sup>e</sup> Center /axis\ of an orbicular movem<sup>t</sup>, and Consequently the detrusion of ~~others~~ /those of less force\ to it Will act as from y<sup>e</sup> Center,

Especially after so Much dissipation of y<sup>e</sup> force as from y<sup>e</sup> Exterior towards y<sup>e</sup> Interior parts. ffor a planet is but a point to its vortex, and there Cannot be found a regular tendency secundum axia<sup>70</sup> there, unless, the part's moving were Regular, as to Every point /of y<sup>e</sup> axis to y<sup>e</sup> Extreame part\ a plan of Cubes fitted So as none deviate. but as the plan of any point of y<sup>e</sup> axis, throws its Influence Into Every other plan, so Every other plan throws Its Influence to that, producing /motion in\ Every ~~motion~~ direction that in y<sup>e</sup> least makes way for y<sup>e</sup> force If there be any dfference /from hence\ of More or less /or in y<sup>e</sup> [Manner?]\ of Gravity, it is towards y<sup>e</sup> pole of y<sup>e</sup> vortex, & Not y<sup>e</sup> pole of y<sup>e</sup> planet. and perhaps towards the Exterior part's of y<sup>e</sup> Vortex, the perpendicular, May somewhat Incline to the axis. and Strictly Speaking In y<sup>e</sup> very pole of the vortex there is No gravity at all, but this Cannot be Sayd of y<sup>e</sup> pole of y<sup>e</sup> planet.  $w^{ch}$  is Influenced from y<sup>e</sup> very Equator. This seem's to be proved by y<sup>e</sup> undulations on y<sup>e</sup> Surface of water; ffor whatever

figured

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<sup>70</sup> Presumably meaning secondary to the axis.

The Event's of Multitudinous forces, In all directions fortuitously have a /are\ different event from cases of a single Impuls. for a Single body Not Influenced by others, tends from y<sup>e</sup> axis, but In a Sphear of Such Impulse's, It is to or from y<sup>e</sup> Center.

The rule of Sinking, & Swimming from comparison of weight, between the body, and of the quantity of water put out of place.

figured body, as a cube or paralepipedon Impresses y<sup>e</sup> Surface of water, y<sup>e</sup> undulations are round, and If oblong at first, they soon become ~~æ~~ /Round\. And light /Entring\ at a square hole, on y<sup>e</sup> Wall cast's a/on wall & at more distance\ round figure & If oblong oval, & continually by distance neerer Round. Therefore Geometrick rules of Single body's, are Not rules of body's In fluido,<sup>71</sup> taken Collectively. but the Results are Compound of So Many and So various, that the Effect's as /in\ some forme that agrees with all, & are not to be charged on any In-particular.

But to Returne to y<sup>e</sup> fluid, I have here Shewed y<sup>e</sup> undulation's, but the affinity between them and Spring's or pendulums is Reserved to another place. yet I must take Notice of the rule de Insidentibus humido,<sup>72</sup> that is when Solids are put Into a fluid, whither they shall sink or rise, & how much above y<sup>e</sup> Surface; and It is thus. If the body hath more power of Gravity then the same Content of y<sup>e</sup> fluid, It Shall Sink, or Els Swim, and rise above the Surface, till the Content of wa y<sup>e</sup> fluid put out of level, is Exactly Equall In weight to y<sup>e</sup> whole body, as well above as under  
y<sup>e</sup>

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<sup>71</sup> i.e., 'in a fluid'

<sup>72</sup> see note on f. 22r.

\*  
 And In that Case  
 a body that poise  
 aloft will poise  
 below. but If y<sup>e</sup> fluid  
 be Compressible &  
 Elastick, It is other=  
 wise and \*\*

The Surface of  
 y<sup>e</sup> Same fluid, y<sup>t</sup>  
 hath perpetuall  
 communication  
 whither Interrupted  
 or Not will be level.

y<sup>e</sup> Surface. and If y<sup>e</sup> body be Exactly par  
 In weight with its place in y<sup>e</sup> water, the  
 upper surface of y<sup>e</sup> body & of y<sup>e</sup> water will  
 be Coincident. Now here will be a difference  
 between a fluid Elastick, or Not; ffor If y<sup>e</sup>  
 fluid be Incompressible, ~~the Same~~ /Equall\ Quantity is  
 In ~~Each~~ /Equall\ Content In all places high & low \*  
~~In that~~ \*\* a body w<sup>ch</sup> Equipoises at the top  
 Shall be light at y<sup>e</sup> bottom of [water] such  
 fluid. because there is More Quantity of the  
 Gravitating fluid, Comprest Into equall space  
 below then aloft; Whereby It May happen  
 that In y<sup>e</sup> air, for Instance, a body w<sup>ch</sup> aloft  
 Shall Equilibrate, Shall /&\ Neither rise Nor fall  
 because In that place the same Quantity of  
 fluid as would fill y<sup>e</sup> place of y<sup>e</sup> body, Is of y<sup>e</sup>  
 same Exact tendency; but If it be taken up  
 higher It will sink, If lower rise. By this  
 It appear's, that compressure of y<sup>e</sup> Ether In  
 y<sup>e</sup> vortex, may make a constitution as may  
 detein y<sup>e</sup> planetts In their orbes, as well as  
 the Specifick gravity of y<sup>e</sup> Matter, w<sup>ch</sup> was  
 discours't on before.

Now It may be seasonable to take Notice,  
 that this surface of a fluid, such as water,  
 must allwais be levell whither Intire or  
 Interrupted. ffor Nothing can press any part  
 of the surface, that is Not above it. and how  
 the

Water, & all Gra=  
vitating fluids  
are sustained by y<sup>e</sup>  
base. and each  
part of water is  
prest, as it is high  
or low; and No  
part of y<sup>e</sup> vessell  
hath More pressure  
the y<sup>e</sup> fluid y<sup>t</sup> is  
Contiguous to it  
for by mean's  
that it is prest.

g<sup>a</sup> all this

the action is ledd about matters Not y<sup>e</sup> Result  
is the Same. Some have bin Inclined to thinck  
that /in\ a syfon Inverted with one leg as a  
funnell, y<sup>e</sup> water Must stand higher /In the smaller part\  
then in  
y<sup>e</sup> funnell; but y<sup>e</sup> Contrary is true; ffor the levell  
is y<sup>e</sup> Same, as in any Surface Not devided, w<sup>ch</sup>  
to Make more plaine. wee Must Consider a  
fluid Rest's upon its base, or vessell that Con=  
teines it. and Each point of y<sup>e</sup> vessell is  
more or less pres't, according to y<sup>e</sup> level place  
It hath In y<sup>e</sup> fluid; If at y<sup>e</sup> very Surface, It is but  
just pres't, & No More. ffor there is y<sup>e</sup> beginning  
of y<sup>e</sup> pressure. but Every point lower, accor=  
dingly, and y<sup>e</sup> bottom If levell, In all points  
Equally. ffor the whole Rest's upon the whole  
base, and what bear's on y<sup>e</sup> Sides doth Not  
bear on y<sup>e</sup> bottom. If the Sides are upright  
or diverging downewards, one cannot say  
ought of y<sup>e</sup> fluid ~~presseth~~ Rest's upon them  
but upon y<sup>e</sup> bottom. but If y<sup>e</sup> Sides diverg  
upward, then so Much becomes as base to  
Sustain y<sup>e</sup> weight. Now If a vessell be perfo=  
rated at the bottom, y<sup>e</sup> force ~~is y<sup>e</sup> Same~~ to  
Evacuate, whither y<sup>e</sup> foramen be larg or  
small, y<sup>e</sup> is Equall ~~but~~ as to celerity, ~~the~~ /but not for  
Quantity\ for  
y<sup>e</sup> Greater Quantity moving, hath More force  
and So will Require more force to Repell it  
ffor

ffor Gravity In Every body, is a force by w<sup>ch</sup> it is Moved In a certain celerity' If the same Gravitating Matter be Much plyed the force Increaseth, as Gross body's having all y<sup>e</sup> Same celerity, but the celerity is y<sup>e</sup> same how Much soever there is of it. from thence w<sup>he</sup> wee have a Maxime In hydrostaticks, that the pressure of Every fluid. or the force Required to sustein or lift a fluid, is as the vent. that is as y<sup>e</sup> Quantity permitted to Move at once.

Whither y<sup>e</sup> Sides of a vessell sustein part of a fluid conteined.

Now however the /upright\ Sides are prest, by y<sup>e</sup> pressure of the whole, yet they doe Not sustein any part no More, then any part of y<sup>e</sup> level susteines that w<sup>ch</sup> is Next it. ffor as y<sup>e</sup> action is ledd Every way, to & from all part's of y<sup>e</sup> fluid, & thro all, whereby wherever a void is made ffor any part to discend it moves, and also is thrust by Every part that, by that moving May ffollow. So it also fall's upon y<sup>e</sup> Sides of y<sup>e</sup> vessell, & meets a Repercussion, till at y<sup>e</sup> bottom, there is No Repercussion upwards. ffor that reason I Say that the Sides of a vessell are prest, but doe Not sustein y<sup>e</sup> force, ffor that ly's all on y<sup>e</sup> base. And that is composed of all points of the vessell, w<sup>ch</sup> permitt No movem<sup>t</sup> farther. lett us put to Case in Simples. As A. B. C. is a vessell, & A & B. part's of a fluid stoped from decending

q<sup>a</sup> this; It seems mistaken<sup>73</sup>

<diagram>

A farther Expli-  
cation of the sides  
not sustaining y<sup>e</sup>  
weight but y<sup>e</sup>  
Base onely. from  
a body Not Re=  
[darded?] in,  
[discent?]  
by Reflecting downe=  
wards.

=cending to y<sup>e</sup> bottom, at y<sup>e</sup> points e.o. It can=  
not be Say'd that D. E. Susteines. A. & B. for  
If y<sup>e</sup> fulcrum. C. were away, they would descend  
without Impediment, (friction apart) but yet  
press at D. & E. & If those support's were away  
ffall, towards D. & E. outwards. So fluids press  
y<sup>e</sup> Sides, but y<sup>e</sup> bottom susteines them.

It will be here objected that the sides doe  
really here sustein A. & B. ffor If a scale  
were applyed at e. and a. It would be  
found that so much of y<sup>e</sup> weight as bears by  
leaning, would fall short In y<sup>e</sup> weight. I. admitt  
that to be so; but wee must distinguish be=  
tween Resting body, & Moving; as here If  
If the body B. come from G. and Struck an  
Imens Impediment at E. and so was Reflec=  
ted to the bottom. It fell with Equall fforce at  
y<sup>e</sup> bottom as If not Reflected at E. but Came  
directly from B. And a fluid is a body perpe=  
tually struck & perpetually moving, and If there  
be obliquitys the Sume of them amount[s?] to  
a direct. but the obliquitys are answered by  
a perpetuall percussion downewards, w<sup>ch</sup> makes  
Every part Not touching y<sup>e</sup> Sides strike y<sup>e</sup> bot=  
tome directly & those that touch y<sup>e</sup> Sides by  
Reflexion. So that y<sup>e</sup> action of Gravity, is very  
different In fluids as to pressing then It is  
On Resting solids /w<sup>ch</sup> have No Reflex action, as fluids  
have\ . as for Instance lett a

tube

---

<sup>73</sup> This note seems to refer more to the diagram than the text.



Difference between fluids & solids, the latter Rest on y<sup>e</sup> Sides, but Not y<sup>e</sup> other becaus always in Motion.

The perpendicular is y<sup>e</sup> gage of fluids pressing onely friction is to be allow'd, for w<sup>ch</sup> In small parcells Is very Considerable

The force of pressing, is as y<sup>e</sup> place or vent chosen to Receiv y<sup>e</sup> pressure, or Issue, according to the perpendicular gage.

tube be filled with a fluid, as Mercury, the pressure of y<sup>e</sup> Columnne, is according to the upright length; but ffill it with sand or shott and there will Not be Neer y<sup>e</sup> whole weight at y<sup>e</sup> bottom, because the leaning ag<sup>t</sup> y<sup>e</sup> Sides, as well as friction takes it off. And ffluids are Impeded by friction as well as solids, w<sup>ch</sup> a small capillary tube proves, In w<sup>ch</sup> fluids Even mercury will Not In a small shred descend ag<sup>t</sup> it, with y<sup>e</sup> force of its owne weight.

Hence are diver's Corollarys, concerning fluids As. 1. that of whatever shape a vessell is the pressure of y<sup>e</sup> liquor upon it self, is as the perpendicular gage. As If you would ask in a conduct of multifarious turnes E= very way, how is y<sup>e</sup> pressure at any place Given. It is answered by the place In a levell below the surface at y<sup>e</sup> Entrance. but here friction will be so Great, that Shall hold a liquid from passing, therefore in practis that is to be Much looked after.

2. That the fforce pressing, is according to y<sup>e</sup> magnitude at y<sup>e</sup> vent, whatever allowances are may made by Inlargem<sup>t</sup> of room Elsewhere. ffor If an hole be opened of an Inch bore, and of. 2. inches, /eubiek Quadrate\ the forces to Resist, and so to obtrude at these foramina Respectively Sufficient Must be as. /overall?\ 1. to. 2.

The Hydrostatick  
rules, are consonant  
to y<sup>e</sup> Rules of Sim=  
ple Motion.

The columnne pres=  
sing, In y<sup>e</sup> Comon  
Style, is not y<sup>e</sup> very  
matter Impending  
but onely In y<sup>e</sup> Way  
of Measure.

~~the~~ /in\ root's of ~~squares~~, /not as 1. to. 4\ becaus y<sup>e</sup>  
Spaces are  
on y<sup>e</sup> flatt. In practis of water work this is a  
great guide in y<sup>e</sup> account of force. ffor If y<sup>e</sup>  
water of a tube of 2. Inches diameter  
must be forc't thro a pipe of 1. Inch bore,  
If the lifting Requires, 1. /x 1.\ Cubick Quadrate  
the force must be Increas't to. 2 x. 2. = 4.  
And so observe, that the water must issue  
at y<sup>e</sup> vent faster then the force Moves in  
Same proportion, & so Reverst. W<sup>ch</sup> Shews  
that even y<sup>e</sup> laws of hydrostaticks are Con=  
sonant to those of Simple Motion, that time  
& ~~force~~ Quantity are Ingredient's of force alike.  
ffor order it how you will, more work with y<sup>e</sup>  
same force will have more time & 'E contra.<sup>74</sup>

Hence it is a Comon style in fluido-Me=  
chanicks, that ~~it~~ is a columnne of the fluid  
~~that~~ presseth. w<sup>ch</sup> must Not be understood  
specifically, as of the matter directly Im=  
pending, but ad Mensuram<sup>75</sup> onely; ffor If  
all the Impending fluid presseth all parts  
below where it can pass, a larger part hath  
a larger pressure, and the sume of all the  
part's press, is y<sup>e</sup> sume of y<sup>e</sup> support of all y<sup>t</sup>  
presseth. y<sup>e</sup> sides of a vessell, are Reputed  
as y<sup>e</sup> bottom in y<sup>e</sup> place, for y<sup>e</sup> Effect would  
be y<sup>e</sup> Same. thus wee Say also, that No wa=  
ter presseth but what may pass; that is  
more

<sup>74</sup> i.e., 'and the contrary', or 'the terms set the other way around would also be true.'

<sup>75</sup> i.e., 'by measure', a legal term.

No water presseth  
but what May  
pass. vis<sup>t</sup> as y<sup>e</sup> pres=  
sure up/on\ y<sup>e</sup> water  
at y<sup>e</sup> vent, so y<sup>e</sup>  
force to Issue.

The pressure of  
y<sup>e</sup> air is More  
exactly Measu=  
red by y<sup>e</sup> Impen=  
ding Columne  
then other fluids

more space letts out more Quantity; Some May  
say, that a small foramen /towards\ at y<sup>e</sup> bottom of y<sup>e</sup>  
vessell shall project farther then a greateer  
with a center at y<sup>e</sup> Same height; be that so  
It is answered partly by this that the lower  
water of y<sup>e</sup> foramen moves swifter then the  
upper, becaus more prest; and Gravity doth Not  
work upon small thing's So much as on great  
to Incline them downewards, of w<sup>ch</sup> Elsewhere.

3. In y<sup>e</sup> world abroad, where y<sup>e</sup> pressure of the  
air, for Instance, is Inclosed round by its  
proper force, and lean's on y<sup>e</sup> Earth the Just  
Measure of y<sup>e</sup> pressure Incumbent on any part /to y<sup>e</sup> whole\  
is as the part to y<sup>e</sup> whole Earth, that is as y<sup>e</sup>  
columne, or rather the frustum of a cone or  
piramid (for perpendiculars are directed  
to y<sup>e</sup> Center) of air Impending. but the ac=  
tuall force is not from that but from Every  
part superior, Quaquaversum,<sup>76</sup> More or less.  
And In the Ether, ~~If there be a Spring It~~ /the pressure, &  
consequently spring\ is Most  
at y<sup>e</sup> Exterior parts, and that measured by  
a Revers, y<sup>t</sup> is a frustrum of a cone or pira=  
midd upon any part of the limits /supposing them  
terminated\ Extending  
towards y<sup>e</sup> Sun. W<sup>ch</sup> may as well be called y<sup>e</sup>  
columne Reverst, as y<sup>e</sup> other y<sup>e</sup> Columne Im=  
pending. But towards y<sup>e</sup> poles, as I Noted there  
may be Some alteration. thus Much I have  
thought fitt to Say of fluids as being y<sup>e</sup> Grea=  
test Ingredient In y<sup>e</sup> Composition of y<sup>e</sup> World.

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<sup>76</sup> i.e., 'going from all sides in to the centre'

fluids have a  
great share for y<sup>e</sup>  
univer's, so y<sup>e</sup>  
laws of them tou=  
ched here.

The probability  
that y<sup>e</sup> fixed starrs  
are Sunns.

I have treated this subject of fluids, with  
more particularity, then may be thought pro=  
per In this place, much of it being proper  
to a subject apart, w<sup>ch</sup> is All true Enough  
and may occasion Some Repetition; but Since  
the Machine of y<sup>e</sup> univer's consists of fluids  
and Solids Immerst and Natant in them,  
It was but Needfull to pass the cheif propo=  
sition's of it; And Now it Remaines to make  
y<sup>e</sup> needfull application's: And I Shall begin at  
y<sup>e</sup> Confines and work downwards towards y<sup>e</sup>  
sun. </ flourish>

Our first Notion is, the whole systeme of  
the Sun & planets, with y<sup>e</sup> fluid or vortex  
on w<sup>ch</sup> their movement depends. The Immen=  
sity of this I need Not Insist on, It is Enough to  
note, that y<sup>e</sup> orbit of y<sup>e</sup> sun is as /a point\ nothing to to  
it,  
then what are wee? The complement of y<sup>e</sup>  
world is made up by Imagination, as distan=  
ces so Infinite are Supplied by Repetition; wee  
also add vortexes to that of the solar systeme,  
by Imagination, In w<sup>ch</sup> wee have no guid,  
but y<sup>e</sup> fixedness of y<sup>e</sup> Starr's, wherein, as well  
as by their light, they emulate y<sup>e</sup> sun, and  
discover a likeness In Nature, and then Why  
not In constitution & circumstances. thus  
ffarr wee have discovery, that is some  
argument

Argument for it; I am sure nature affords us No argument agains't, Therefore a Meer Naturalist may be allow'd to be of that opinion; and as for argument's theologicall, When it is proved that filosoficall speculations, are to be guided by any text, but that of Nature /itself\ I will hearken to 'em. but this is a matter /already\ Enough debated & Refelled among y<sup>e</sup> vertuosi.

The probability that among vortexes, poles are ag<sup>t</sup> Equators. & of y<sup>e</sup> Spondrills or Interstitiall spaces w<sup>ch</sup> must be Imployed as Eddy's of y<sup>e</sup> Greater Motions, where things May Stagnate.

Therefore taking this Systeme ffor granted, wee may add, with Cartesius, a probability That y<sup>e</sup> poles of some vortexes, are ag<sup>t</sup> y<sup>e</sup> Equators of other's. but Whither it be so allways, or but accidentally onely, or how= Ever they fall towards one & other; there Must be great spaces /room\ In the angular spaces, they Call spondrills, where y<sup>e</sup> matter doth Not ffollow y<sup>e</sup> Cours of any vortex, but may make Irregular eddy's, and yeild or bend out y<sup>e</sup> vortex, where such are open & larg, In this Respect partaking of y<sup>e</sup> property's of Currents, w<sup>ch</sup> against anfractous Shoars, finds some shelters, & makes eddy's, and Is In short a fring of Irregularity's and Contingent Movement's, sometimes tossing Into y<sup>e</sup> Current matter Gathered In, & Sometimes Gathering from it: And If accidentally a  
great

The Elliptick forme of planetary orbs, is from those Spaces, giving Way larglely, in one side More then on another.

Comet's May be tossed In these Spondrills, and Sometimes accidentally slipp In to a vortex, & by y<sup>e</sup> changes it meet's with, be sent out againe

great vortication happen's In an oblong space, wee observe it to degenerate from a circular Into an Elliptick forme. So In y<sup>e</sup> heaven's If some great space ly's open on one side towards Some particular fixt starr's, y<sup>e</sup> vorticall matter may fling Into it, and so Ellipticise the whole movement. And that this is so, is partly proved that the longest diameters are allway's to y<sup>e</sup> Same fixt starrs; w<sup>ch</sup> argues y<sup>e</sup> reason of y<sup>e</sup> Elliptick orbs of y<sup>e</sup> planet's is from circumstances that never Chang.

Another consequence of these Spondrill spaces, is collection of Matter, w<sup>ch</sup> may be casually throwne Into one vortex or other, and there meeting with a Gravitating Circumstance, precipitate downe towards y<sup>e</sup> Sun and Retein withall a vis Impressa, w<sup>ch</sup> bears it somewhat off /as well as beyond the place of resting it would ballance\. And y<sup>t</sup> spent, together with alteration's may be made In it by the heat of the Sun, the tendency May be Intirely changed, Instead of solar Gravity to levity & so chang its Cours, In a trajectoriall line (as is observed) and come about again & Goe off with y<sup>e</sup> like Speed, as It Came. That heat May produce this effect is Not Strang, ffor the heavy part's, such as tend to y<sup>e</sup> Sun, being combustibile

The tail, & Coma  
of Comets, is y<sup>e</sup> light  
of y<sup>e</sup> Sun Reflected  
from vapour as  
a crepusculum.

That y<sup>e</sup> Smoak  
of comet's May goe  
from y<sup>e</sup> Sun.

combustible of fire, may be Exhaled, and then  
the tendency, by y<sup>e</sup> part's best wrought upon  
by heat, is changed. The very path of y<sup>e</sup>  
Motion, being as that of projectiles, argues  
a vis Impressa In directum, & without More  
turning about y<sup>e</sup> Sun, as an obliq Shot  
arrow at y<sup>e</sup> Returne, makes such a figure.  
but the Impetus may well Abated, and  
y<sup>e</sup> Returne hastened by y<sup>e</sup> Consumption y<sup>t</sup> happens  
by fire. And that there is a great Share of that  
the Coma & cauda<sup>77</sup> declare, the body is Never  
terminated but seen thro a cloud of Smoak  
or Mist, being more dusky then the borders of  
it that are but Exhalation. and Seen In y<sup>e</sup>  
Ether, as the Crepusculum is seen In y<sup>e</sup> Evening,  
by mean's of y<sup>e</sup> terrene vapours; So the tail also  
is of the Same Nature, Just as a Crepusculum  
And Ever pointing from y<sup>e</sup> Sun, & Increasing  
with approach to it, and decreasing with y<sup>e</sup>  
Recess; as may be seen In M<sup>r</sup>. Newton.

There may be an objection, that the Mat=  
ter Exhaled, is what wee suppose solarly  
heavy, and Not light, as, by departure from y<sup>e</sup>  
Sun, appears. But It will be answered, If it be  
Considered that heavy matter In vapour  
takes y<sup>e</sup> forme of light; as fume Even of Mer=  
cury will rise. ffor when part's are very Mi=  
nute, they are Resisted by y<sup>e</sup> Medium from falling.  
And

---

<sup>77</sup> The coma is the hazy material around the nucleus of a comet, the cauda is the comet's tail.

These comets may  
Reside In those Re=  
cesses, & not possibly  
be seen by a seconda=  
ry light at such dis=  
tance, or they may  
pass into ether, as  
some into ours, from  
other vortexes, w<sup>ch</sup>  
are matter's cannot  
Ever be determined<sup>78</sup>

Question's of the  
Genesis & decay  
of planetts, or  
Comet's, Not to be  
asked, Nor answered.  
It is Enough to know  
what is possible  
& Consequent to y<sup>e</sup>  
laws of nature; what  
hath bin, is above  
us.

Cometts Not pe=  
riodicall, as y<sup>e</sup>  
latter vertuosi  
dream.

And fire with Exhalation, tho of Matter heavy  
as wood & water, Shall make a current or  
stream upwards, w<sup>ch</sup> carry's off y<sup>e</sup> Smoak, as  
the steam of a Comet from y<sup>e</sup> body, y<sup>t</sup> affords it.  
All w<sup>ch</sup> belonging to y<sup>e</sup> Subject of fire, is Reser=  
ved for farther Explanation there. It is Enough  
here to shew that the Same action of heavy  
body's raised by fire /In smoak & vapour\ appear's among's  
us  
In y<sup>e</sup> Same manner as y<sup>e</sup> tail of a Comet In  
y<sup>e</sup> Solar vortex.

Whither a Comet be an obsorped ~~planet~~ /sun or planet\  
or if our planet's were Ever Sun's, & y<sup>e</sup>  
like, are Question's neither to be asked, Nor  
Resolved, It is Not Impossible In nature that  
they should be so; but a possibile ad Esse Non  
valet argumentum.<sup>79</sup> But that Comet's are  
periodicall In vast oblong Elipses, Independent  
on y<sup>e</sup> Motion of our Solar System, is a Chi=  
mera, as void of sence as proof. that they  
are Contingent or, If you pleas, preternaturall,  
is proved by all y<sup>e</sup> observation's that Ever were  
made of them; It being found No. 2. Ever had  
y<sup>e</sup> Same path, time, or Circumstance. and yet  
some dream them periodicall, and would have  
it beleaved upon y<sup>e</sup> authority of onely a  
violent Inclination to have it so. As to y<sup>e</sup>  
faces of y<sup>e</sup> Comet to us, there are some posture  
of it

<sup>78</sup> This marginalia seems to be contemporary with the first draft.

<sup>79</sup> i.e., 'to argue that it is because it is possible is not a valid argument'



position Makes a  
comet More or  
less tremendous  
to view.

generall wicked=  
ness is portent E=  
nough without a  
Comet. but coming  
is y<sup>e</sup> Same to all  
Nations, & lett the  
most wicked take it.

The Great force of  
y<sup>e</sup> vis Impressa in  
a large body, &  
Not so so soon lost  
for y<sup>e</sup> part as in  
small, & cometts  
are very larg, &  
persevere hard.

of it, w<sup>ch</sup> makes it appear more formidable  
then ordinary; as when the tail points to=  
wards us. ffor then the perspective view Mag=  
niffyes it, as that In 1670, odd. but If y<sup>e</sup> tail  
points from us it is In like manner deminishe[d?]  
And for being a portent, It is No less for being  
naturall; there is Enough in y<sup>e</sup> order of y<sup>e</sup>  
world outwardly, as well as In observation  
of Consequences, If folks will Make any, to  
denounce the plagues that attend a vicious  
and Corrupt world. but as to any country  
Region or family, it is a strain to Construe  
it portentous, becaus it is y<sup>e</sup> Same appea=  
rance, (I account Not Nicety's here,) to y<sup>e</sup>  
whole globe of y<sup>e</sup> Earth. and It is seldome  
one Can Come, but there is occasion Enough  
ffor Reflexions, & happy are those who upon  
Such or any other occasion, Make them as  
they ought. ~~So Much for Cometts.~~

It May be objected that a Comet shall In  
Such long progress thro y<sup>e</sup> fluid Ether loos Its vis  
Impressa, and So Never arrive as it doth ordina=  
rily, beyond y<sup>e</sup> sun, before it checks. I ans<sup>r</sup>, I doe  
not lay all upon y<sup>e</sup> vis Impressa but Much upon  
Gravitation, and alteration by heat. but If it We[re?]  
Wholly the Vis Impressa, Considering Great body's  
have So Much more force of perseverance more  
then small, No wonder If it last's So long.

The time of y<sup>e</sup> planet's Revolutions being neerer as their distances from y<sup>e</sup> Sun. y<sup>t</sup> is as neerer So More revolution's In y<sup>e</sup> same time. proves a Comon Caus, w<sup>ch</sup> is y<sup>e</sup> Ether Rolling with velocity Neerer Equall, & that in less circles gaines More turnes.

How y<sup>e</sup> vorticated Matter, must fall Into Equall Celestity.

Then Next, as to y<sup>e</sup> knowne planetts, they Revolve Slower by distance from y<sup>e</sup> Sun, where of y<sup>e</sup> times are /knowne to Every one, being\ Compared and accounted by y<sup>e</sup> revolution of y<sup>e</sup> Earth about y<sup>e</sup> Sun Called annuall; It is hard /among y<sup>e</sup> vacuists\ to give a tollerable acc<sup>o</sup>, why It should so happen that y<sup>e</sup> planet's neerer y<sup>e</sup> Sun Should ~~move swiftest,~~ y<sup>e</sup> is make Most frequent turnes. ffor If the Motion was In vacuo, and onely an accidentall Impres't force upon Each planet /In direction\ w<sup>ch</sup> it Reteins, Notwithstanding y<sup>e</sup> sun draw's it Into an Ellips. Why must that order be. Saturne Could have as well have Gone about as frequent a y<sup>e</sup> Earth or Mercury. there is Nothing in Nature ag<sup>t</sup> it. If they Say, that It was hard to Impress So swift a Motion, I ans<sup>r</sup>, It was ~~then~~ Easy to Impress a Slower on Mercury. So that y<sup>e</sup> order of y<sup>e</sup> Revolutions being regulated according to distances, argues some Comon Cause, Capable of Such distribution, and that it was Not accident that Made it. If they Recur to providence, I agree. but Withall [Shew?] that providence doth y<sup>e</sup> work at one Stroke by a Comon Caus, ~~and~~ /otherwise\ Every planet is a distinct work /originally to move or have Imparted a\ ~~by Impuls or~~ vis Impressa In vacuo.

This Caus comon to all, is the vortex of y<sup>e</sup> Sun. whereof y<sup>e</sup> matter moves with neerer y<sup>e</sup> Same velocity In all distances from y<sup>e</sup> center. This I thinck reasonable to argue, ffor If In one part

But still anomala  
will be found about  
ye planetary Revo=  
lution's, w<sup>ch</sup> are Some  
Inequality's Caused  
by Some unknowne  
means.

part the motion is more rapid, It must Influence  
the vicinia and so be dispersed every where  
neerly alike. I say neerly, becaus many things  
may Intervene, & be considerable, w<sup>ch</sup> wee May  
know or Guess, and also /as wee\ cannot Either know or  
Imagin, that may make a deviation, so that  
the velocity of the Etheriall matter may Not  
be exactly as the distances from ye center. as  
matter more or less Gross, & persevering, More  
or less Impediment In ye Confinia of other  
vortexes; w<sup>ch</sup> may Retard ye Remoter part's.  
Whatever it is that may be ye Caus of the  
adjustm<sup>t</sup> of these courses about ye Sun, Wee  
have Not power to Comprehend & know them  
But If It prove that ye Remoter part's are  
slower or swifter, It will fall In some pro=  
portion. W<sup>ch</sup> Mr N. say's is < gap left ><sup>80</sup> of their  
distances. ffor Mixture will happen In all  
movem<sup>ts</sup> to make /towards\ Such Regularity. But  
That the Matter moves with neer ye Same  
speed, is reasonable to Conclude, and then  
the planet's have Revolution's accordingly.  
ffor as the circles or Courses are larger so  
ffewer are accomplisht, and particularly  
Saturne makes but one to 12. of ye Earth  
and so of other's, in certein proportion's  
Referred to the distances, & all under one Caus,  
the

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<sup>80</sup> Perhaps RN meant to insert the words 'the inverse square of', thus saving Newton's  
mathematics (or rather, Robert Hooke's, for he is credited with the formula), if not Newton's  
attraction in a vacuum?

the ordinary Cours of the whole Etheriall  
matter about y<sup>e</sup> Sun.

A strang attempt  
to demonstrate y<sup>e</sup>  
planetary Courses  
more Geometrico.

The supposed pow=  
er's centripetall &  
centrifugall most  
p<sup>r</sup>carious.

I must Confess I thought it a strang at=  
tempt, to demonstrate, more Geometrico<sup>81</sup>  
the courses of y<sup>e</sup> planet's, becaus It is Im=  
possible to know the condition of them so  
Strick't as Geometry Requires, Whose data  
must Not be [Quesita?], as those are. I owne  
it was Subtile Enough, to p<sup>r</sup>suppose certain  
powers, Such as are called Centripetall, or  
Centrifugall, and Institute a Geometrick  
process upon them; and when the oeco=  
nomy of the heaven's, became obnoxious  
to the conclusion's made; all doe Not  
discerne, that the work falters. ffor Why  
Should wee Grant such powers? Nay the  
power's In truth are knowne In the Sim=  
plicity of their operation's, that is the  
Effects of Impulsory motion; but It is Im=  
possible to know how those power's pro=  
duce Such Complex affect's, as wee dayly  
observe to proceed from them, in small  
& Great things continually, becaus wee doe  
Not Know the particulars or parts, that  
constitute the totum's. how then can the  
totum's, (admitting them Such as they  
demand) be a ~~subject of~~ /principles for geometrick\  
demonstration,

w<sup>ch</sup>

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<sup>81</sup> i.e., by means of geometry.

Agreem't with Nature No argument, ffor nature may work upon principles of another Quality then are Supposed.

All account's of y<sup>e</sup> planets have bin by time found fals.

All that can be expected of the heavens is phisicall conjecture.

w<sup>ch</sup> are not Intrinsically knowne? but say they, It is No Matter from what Cause If there be Such vires.<sup>82</sup> true, but that's the Question. If they say that the vires agree with Nature, I may reply, that the phenomena may be neerly, as if Such vires were, but I deny all exactness; and then Surely mathematick's Reject them. And Nothing could have bin found out So unfitt for Mathematick process, as the Systeme of the heavens, In w<sup>ch</sup> there is Nothing so Constant, or certein, as such learning deals In. or rather leans on. I may affirme that all accounts /of y<sup>e</sup> planets have bin\ by observation found fals; what Nothing In an Instrument with us, is Not a vast lacuna In the heaven's? If accounts by the help, of ferè,<sup>83</sup> or a litle more or less; serves a p<sup>r</sup>sent occasion, In an age or two, It becomes grosly Erroneous. Such is y<sup>e</sup> fate of the best tables and Ephemerides; and the Modern's doe Not Correct them, without being consious of like fate & frailety attending their Measures. What's here then ffitt ffor a geometrick course? neither Quantity, time, Nor figure Exact, Equall, or Comensurate? therefore wee can p<sup>r</sup>tend but to phisicall Conjecture of y<sup>e</sup> planetary regions; all Els is  
vanity

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<sup>82</sup> i.e., 'force'

<sup>83</sup> i.e., 'almost, nearly, more or less'

The Courses of the planets cannot be In any Exact figure no More then other fluids y<sup>t</sup> move in Uneven limitts.

When congruency with Nature is Shewed, demonstration Ends. Els y<sup>e</sup> principles prove y<sup>e</sup> Event, & y<sup>e</sup> Event y<sup>e</sup> principles. a Circle

vanity & affectation; the Enterteinem<sup>t</sup> of habituall analists, who are used to a Method, and thinck all Subjects proper for it; who Els could Imagin, that when y<sup>e</sup> Space of our world is not even In y<sup>e</sup> Confines, (and what naturally is So?) but, as shoars, uneven, by reason of bay's, and promontorys; whereby that w<sup>ch</sup> would be a Sphericall Movement degenerates Into ovals, as wee see ordinary currents of water produce In their Eddys when straitned; must needs have this /caus\ become a just Conick Ellips; perhaps It May be the Cartesian, or of any other Invention or Ovall, larger at one End then at y<sup>e</sup> other. but ffor certein wee May Conclude it is No Exact figure, of any denomination, ffor Nature Contrives None Such.

It is yet More Strang, that this Mathematick hypothesis, is proved onely by a Congruence with y<sup>e</sup> phenomena; but yet held forth as demonstrated, to proceed from Reciprocall attraction of the planets, diverting Each other, from their strait, to Elliptick courses; phenomena may agree with divers hypotheses, and but one be true; therefore agreem<sup>t</sup>, is a Strang way of demonstrating And y<sup>e</sup> attraction hath the same proof

Returned

Attraction and vacuum, two Strang mathematical principles.

most strang that elliptick Courses cannot be, If y<sup>e</sup> planet's are librated in fluido

Returned; that is, Attraction /(If such be)\ is proved to produce such Courses In vacuo; but that attraction is but p<sup>r</sup>sumed without proof, unless the Courses prove it, as /a\ thing that May be, therefore is, but what is y<sup>e</sup> Congruency? the planets describe Equall areas, In Equall times; And all this with a, ferè; & Quam proximè,<sup>84</sup> Esteeming degrees & Minutes So Inconsiderable, as, If but ffew, to be Slighted; and It may be so, upon our Quadrant, w<sup>ch</sup> is Nice enough /even\ to. 2<sup>ds</sup> 3<sup>ii</sup> & 4<sup>iii</sup>. but In the heaven's Such Spaces opening so small angles in y<sup>e</sup> very center point /w<sup>ch</sup> there\ are Inconsiderable, ~~tho perhaps~~, at y<sup>e</sup> place observed, they are as Much as y<sup>e</sup> Globe of y<sup>e</sup> Earth, Sun, & perhap's y<sup>e</sup> very anuall orbit. as may happen in observation of Comets & y<sup>e</sup> planet Saturne.

And It is most Most of all Strang that this Method Should p<sup>r</sup>tend to demonstrate, that the planets cannot have by any means, such motion's In orbe Elliptico, If I May So say, by y<sup>e</sup> mea being borne & librated In fluido, who can say that the cours of y<sup>e</sup> fluid Cannot be elliptick, or Near it, or that The Quickness or slowness of /it\ at certain distances may Not be Such, as will answer th phenomena, or upon caus as may

happen

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<sup>84</sup> i.e., 'as nearly as possible', a phrase used by Newton in the *Principia*.

The cours of all  
ye planet's one  
way, and with  
such difference  
of Revolutions  
as distances, con=  
forme a Comon  
caus. Els, why Not  
one one way and  
another, another?

So the gathering  
towards ye Equinoc=  
tiall of ye world. w<sup>ch</sup>  
is ye place of Most  
Recess.

No hypothesis can  
be proper If Not  
founded on palpable  
principles, w<sup>ch</sup> attrac=  
tion & vacuity are  
not.

happen (for causes here are secrets to us) prove  
In almost any Manner, or proportion: If there  
were any Strang Contradictory Cours, as If  
mars should move from East to west, &  
Jupiter from west to East, & ye other planets  
so chim cham, in opposed Courses; It were a  
Shrew'd argument ag<sup>t</sup> the plenitude and  
cours of ye Etheriall World. but whilst they  
all Move in the same direction, and per  
forme Revolutions oftner, as neerer to ye  
center, w<sup>ch</sup> is a Most Naturall property of  
a fluid put in motion; and all gather to  
the Equinoxiall part's or regions where ye  
distance from all Center is Greatest. And so  
Comon is it, ffor solids to be borne along by  
fluids, with ye Silence & Eas as ye planets In=  
joy, without any opposition, or (alluding  
to My Relative accounts) Indeed Motion.  
What sence is there, to Suppose a modell  
of ye world adapted ~~Mechanic~~ to this porpose  
with powers cut & dryed for ye Nonce, agreeing  
with Nothing wee know In ye univers; that  
is vacuity, and attraction; w<sup>ch</sup> Never were  
Nor will be proved, and have No likeness  
among us; and lay aside a most [Native?]  
hypothesis that is Grounded on palpable  
principles, and Indeed, ffrom the Conformity of  
it to ye knowne world, litle less then proves it Self



But more then Enough of this Controversies Now wee will Condiscend by degrees to y<sup>e</sup> planets as they ly In order towards y<sup>e</sup> Sun, and observe what I may Concerning them. and first of Saturne, the Most Remote, who performes a Revolution, once in 30, of y<sup>e</sup> Earth.

Of Saturne, & y<sup>e</sup> probability of its similitude & uses as y<sup>e</sup> Earth.

Saturne is a gross body, of w<sup>ch</sup> wee have a comparative knowledg from y<sup>e</sup> Earth wee live upon; ffor such wee beleev that, as also y<sup>e</sup> rest of y<sup>e</sup> planet's, are, In a word terraqueaous. but farther wee have no glimps of discovery. as Whither it be more earth or water; If the earth be stone, sand, shingle, mould, or Re=pleat with mettalls, obnoxious to vegetables, stockt with animalls, or y<sup>e</sup> like, more or less then y<sup>e</sup> Earth, wee are too farr off to discern onely as saylors, when they see land con=clude of water plants, animals, & Inhabi=tant's, tho Not necessary in nature to be there So with a parity of argument to o<sup>r</sup>selves w[e] conclude y<sup>e</sup> planet's, and Saturne In parti=cular, to be Earths Inhabitable as ours is, & as to Inhabitants, with proper conveniences of life, whither like any here or Not, wee thro Inn, saying, with Mons<sup>r</sup> Hugins, why not? There is our Non plus.

<diagram in pencil>

Saturne Revolves  
hath 5. Moons &  
A larg Ring In=  
Compassing it.  
w<sup>ch</sup> demonstrate  
a subvortex.

That Saturne hath Nocturnall luminary's  
that have periodicall courses round about  
him, to y<sup>e</sup> Number of 5. and More suspected,  
late observation's with help of telescopes In=  
forme us. And also, what is to us Most won=  
derfull, that an Imen's Ring Incompasseth  
the planet, with vast ~~diff~~ distance between  
but Cocentrick, and lying neer y<sup>e</sup> plan of  
our anuall orb, called y<sup>e</sup> Eccliptick. And  
the luninary's wee Call sub-planets Revolve  
On planns, neer the plan of the Ring, this  
is the Economy of Saturne. from whence Wee  
argue that a portion of y<sup>e</sup> Etheriall Matter  
hath a Cours round y<sup>e</sup> planet, as the Whole  
hath round y<sup>e</sup> Sun, wherefore I style it a  
Subvortex. A litle Reflection on what hath  
bin sayd of motion In generall and the  
consistency of all sorts In y<sup>e</sup> Same Subject,  
will satisfye us that this is possible, and  
considering [y<sup>t</sup>?] y<sup>e</sup> Grand vortex to that is  
but as a Current, and a vortex in a Cur=  
rent or stream, is y<sup>e</sup> Same In effect as In a  
standing pool; and If we Respect possibility  
there may be subvortexes ad Infinitum, & y<sup>t</sup>  
without Improbability /so farr from\ ~~ex~~ Inconsistency,  
ffor  
how Many turbo's & vortications have wee  
In y<sup>e</sup> air & water, & why Not In great as in litle  
S<sup>r</sup>. Is N

onely saturne  
 Jupiter & y<sup>e</sup> Earth  
 as wee can find  
 have subvortexes  
 those say'd to be  
 lyable to wast,  
 & so Must decay.

/sub-\vortexes not  
 Neer  
 y<sup>e</sup> center, Not ab=  
 sorpable. as might  
 be if neerer.

S<sup>r</sup>. Is. N. argues against these Subvortexes, &  
 mostly ~~up-on~~ upon y<sup>e</sup> point of wasting. w<sup>ch</sup>  
 matter was touch't before on occasion off the  
 Solar vortex. but It comes neerer us here, be=  
 caus y<sup>e</sup> subvortexes are so Much less, then the  
 Grand vortex of y<sup>e</sup> Sun, that Carry's them all.  
 ffor without doubdt wasting is more, as mag=  
 nitude is less. So wee must translate y<sup>e</sup> argu=  
 ment to the subvortex of saturne, Jupiter,  
 & y<sup>e</sup> Earth, w<sup>ch</sup> latter is y<sup>e</sup> Smallest, there being  
 none discoverable, of venus & mercury.

1. As to the Matter of being absorped by the  
 Greater, It is to be observed, that there is No  
 Subvortex, but at a Competent distance from  
 y<sup>e</sup> Center of y<sup>e</sup> Great one. ffor the larger y<sup>e</sup> Cir[=]  
 cle of Revolution, the neerer a strait line,  
 and So less absorpable, then when bending  
 In less circles; ffor that will be readily Gran[=]  
 ted, If a Subvortex, be by any force ~~p<sup>r</sup>e~~/de\truded  
 downe neerer the center of the maine one, at  
 a certein distance the latter Shall suck in  
 y<sup>e</sup> other. Therefore venus & Mercury Cannot  
 have vortexes, being So neer y<sup>e</sup> Sun. but y<sup>e</sup>  
 first is that of y<sup>e</sup> Earth; and y<sup>e</sup> least as May  
 be argued from one onely Moon It carrys  
 When ~~venus~~ /Jupiter\ & Saturne have at y<sup>e</sup> least 4.  
 Whither Mars hath any or Not doth not  
 appear

Tho Mars be  
farther from y<sup>e</sup>  
Sun then y<sup>e</sup> Earth  
It hath No vor=  
tex; becaus lying  
between Jupiter  
& y<sup>e</sup> Earth, there  
is Not room for it

The wasting is  
Not charged on  
y<sup>e</sup> planet's, but Must  
belong to y<sup>t</sup> Ethe=  
riall Matter or  
vortexes y<sup>t</sup> Cary's  
them.

appear to us, but y<sup>e</sup> latter is concluded becaus  
there is neither moon about, it Nor Revolu=  
tion of the face of it discovered. but yet it is  
at /competent\ distance /being\ between Jupiter & y<sup>e</sup>  
Earth, both  
w<sup>ch</sup> have subvortexes. It May be there is  
Not room, between those two to admitt a=  
nother, and If ever Mars had one, it Is pos=  
sible ~~mars~~ Jupiter, or y<sup>e</sup> earth may have ab=  
sorped it. but at Greater distance from y<sup>e</sup> Sun  
y<sup>e</sup> orbs Come neerer Strait lines, & there is room  
ffor that of Jupiter & Saturne to Consist, and  
yet a Great space of Ether be between. So Much  
about absorpment.

2. ffor the wasting, as wee find projectiles  
doe of their force. that Cannot be charged  
having No projected force, but pass In a Current,  
and then y<sup>e</sup> wasting must be Charged on y<sup>e</sup>  
Current, and Not on y<sup>e</sup> body floating in it;  
ffor that will pass on to Eternity, In y<sup>e</sup> Same  
manner If the Current so long Continues. So Wee  
are to Inquire what Should stop this Current,  
ffor such there is, of a vortex of Ethereall  
matter about saturne. Why It moves, Is Not  
to be asked, ffor that is so, however it began,  
the Question onely is of obstruction, w<sup>ch</sup> Should  
wast its Speed, and finally, bring it to Nothing.  
whither

No accessionall  
matter at y<sup>e</sup> poles  
Required according  
to Cartesius

vortexes Must  
wast, but In what  
time?

1. the Ether is  
least tenacious  
so y<sup>e</sup> friction less  
then in water or  
air.

Small whirlpo=  
ols In water will  
continue many  
revolutions, as  
topps also In the  
air, being once  
put in Motion.

Whither ther be any accessionall force from  
without Entering at y<sup>e</sup> polar Regions or other  
wise, as Cartes Imagines, I will Not Inquire  
but Suppose there is None, becaus wee have  
Not discovery sufficient; And then Confor=  
mable to observation of thing's In lesser  
magnitudes, I Must admitt that a fluid put  
Into a vorticall Motion, In a More Extended  
body of y<sup>e</sup> Same, as a whirle pool In the sea  
supposed otherwise stagnant, Must wast, be=  
caus the limitaneous part's are Not In the  
same Cours, but In the Nature of friction this  
Whirlepool must wast and at length come  
to Naught. But In What time? It is answe=  
red, In More or less, according to the Magni=  
tude of y<sup>e</sup> body's, and spissitude or tenacity  
of the body. wee may have it readily ad=  
mittid that y<sup>e</sup> Ether is y<sup>e</sup> least tenacious of  
any body whatever, that wee know. so y<sup>t</sup>  
If y<sup>e</sup> whirlepool were in water or Even in  
air ~~In~~ it would wast Much faster, then In  
Ether. Then wee have Experience of vortica=  
tions of water, Either In vessells /when y<sup>e</sup> friction from  
Gravity is Not a litle\ or In open  
pools, w<sup>ch</sup> once put In motion, tho Not of  
a foot diameter, Shall continue the mo=  
tion neer y<sup>e</sup> Same Swiftness neer a Minute,  
ffor, In Making an Estimate, I would hold  
in

In so great body's, as ye very planets, motion would Not sensibly wast In a Miriad of years. What then of the vortexes?

The planet's may have Slackened Some what but Not Considerably Since ye creation: but No acc<sup>o</sup> being kept of it, Nothing is to be affirmed either way.

in secure termes. then Compute, after ye rule of the force Increasing in triplicate proportion of the Substance, and the Impediment decreasing by loss of half, Every time ye Radix Is dupled. as If 1/2. foot Radix, have. 2. of Impediment, 1. foot Radix shall have. 1. of Impediment. and 2. foot radix. 1/2. of Impediment as was demonstrated. So that If the Globe of Earth, /were water & \ with all the Gravitating friction / put \ In a vessell, ~~should be put~~ /and Sett In a diurnall Motion. It is Not a Miriad of years would abate it sensibly. and what is that to ye time of 7000 years accounted ye age of ye world.<sup>85</sup> What then Is the vortex of ye Earth; or w<sup>ch</sup> is Much More that of Saturne, adding the deminution of friction, by reason Gravity is absent, and ye body, Not so tenacious, as water In a vessell? one Could Not account that a Miriad of miriads of years, could Sensibly abate the velocity of such revolution.

But admitt that Since ye beginning of the world these vortexes, have ~~Not~~ lost some of their velocity; It is like All have lost proportionably, and then ye difference without some, standard is Not perceptible. If the diurnall revolution of ye Earth had bin from ye beginning Isocronous; then the

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<sup>85</sup> We usually point to James Ussher (1581-1656), protestant Bishop of Armagh, (*Annales Veteris Testamenti, a prima mundi origine deducti*; Annals of the Old Testament, deduced from the first origins of the world; Latin edition 1650; English edition, 1658) in order to ridicule the naivety of early modern chronology, however many scholars had attempted a synthetic account of histories, biblical and classical, in order to establish the date of creation. Johannes Kepler (1571-1630) had estimated creation to be in 3992 BC, and Newton, RN's contemporary, dated it to 4000 BC.

The annuall orbit had bin checked with an account of fewer day's In a year then anciently was; but wee find Nothing of that ~~If~~ but If any alteration be, It is In y<sup>e</sup> diurnall as well as anuall Motion. If you say y<sup>e</sup> lives of men are a gage, I ans<sup>r</sup> It is one so Incer= tein it is In No Sort to be trusted, ffor vices Infect y<sup>e</sup> race of men, & Shorten their day's, or the Contrary, we<sup>ch</sup> were to be wish't, their vertues My prolong them. but be y<sup>e</sup> life of a man, a comunis mensura /allowing liberally 100. of our years\  
then the E=  
vidence of the wasting of y<sup>e</sup> heavenly turnes appears /Indeed\  
, In y<sup>e</sup> difference between y<sup>e</sup> lives of y<sup>e</sup> ancient patriarks, and ours. ffor If they lived 2. 3. 00, years a peice, then y<sup>e</sup> Revolution's anuall & diurnall were so Much Swifter, but this account doth Not discend with such measure & proportion as would perswade us there ought to be any deference to it. And un= less wittness Could be brought who held y<sup>e</sup> pen= dulum (the surest & Evenest measurator of time) & kept y<sup>e</sup> account from y<sup>e</sup> Creation to this time; there /really\  
is No ground to suppose any /considerable or\  
sensible chang In y<sup>e</sup> heaven's by a slaking of their speed ~~In-Revoling~~ the Re= volving of the celestiall matter, /some there may have bin but\  
and It is a meer vanity to Insist on wasting, as an  
argument

argument against the vorticall Systeme & plenitude of y<sup>e</sup> heaven's.

The Influence of y<sup>e</sup> Sun's heat is not wholly as distance, but as Reflection's or ~~full~~ fewal make's it.

The Ether Not apt to fire or heat,

2. Another argument I observed In S<sup>r</sup>. Is Newton was, that Saturne must be frozen to a stone, & mercury burnt to a coal; And In shewing this the rules of proportion are set on work, as the heat of y<sup>e</sup> sun at y<sup>e</sup> distance of y<sup>e</sup> Earth, that is what wee feel, so by triplicate Increases is it at the distance of Mercury, and by like deminution, at Saturne, whereof y<sup>e</sup> figures as upon calculate they happen, are prodigious In y<sup>e</sup> way of both Extream's. In ans<sup>r</sup> to w<sup>ch</sup>, I deny the heat of y<sup>e</sup> sun to be, as the distance, but affirme it rather to be as matter is susciptible of heat. ffor a spark is not great becaus it fires y<sup>e</sup> powder y<sup>e</sup> spring's a mine. and I doe Not know that y<sup>e</sup> sun's actuall heat is Considerable in the Comon Ether of y<sup>e</sup> world, unless it meet with calefiabile Matter, as y<sup>e</sup> Spark doth y<sup>e</sup> Combustible powder. ffor according to our Model, the Ethereall matter, is that w<sup>ch</sup> perseveres most In Motion progressively, and then is less appt to be Moved Minutatim.<sup>86</sup> And wee find y<sup>e</sup> heat of y<sup>e</sup> Sun is most where y<sup>e</sup> Sulfur is. In valley's & Recesses, Especially when Reflection upon Reflection, exasperates y<sup>e</sup> agitation; and While there it is So Strong, as to kill Some animalls snow shall lye unmentled on y<sup>e</sup> neighbouring  
moun-

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<sup>86</sup> i.e., 'little by little'



Saturne May  
be Warne from its  
Calefyable Matter,  
and valley's. &c.

Then hath the  
Reflection by its  
Ring, and Some  
service of its Many  
moons. So Not so  
frozen as Supposed,  
and yet If it were,  
might be apt to  
occasion's there.

About Jupiter, the  
Moon's revolve (as  
those of Saturne  
also) neer y<sup>e</sup> ecclip=  
tick of y<sup>e</sup> planet  
and In times as  
distances. w<sup>ch</sup>  
confirnes y<sup>e</sup>  
hypothesis.

mountaines, w<sup>ch</sup> are neerer ~~then~~ y<sup>e</sup> Sun. and  
yet farther off it is colder, y<sup>e</sup> clouds being or=  
dinarily Icy Minute Globules. therefore Such  
calculates are wholly without foundation.  
who knows of what calefyable stuff saturne  
is Composed off. the vortex there is the largest  
of any, and therefore the collection of com=  
bustible matter should be more, at y<sup>e</sup> Center,  
then It is with us, who are upon the setlem<sup>t</sup>  
of a lesser vortex. If so the heat of y<sup>e</sup> Sun at  
y<sup>t</sup> Great distance, may not be wanting to ad=  
minister warmth for y<sup>e</sup> occasion there. And to  
shew that the author of Nature hath Made  
a provision for warmth, by the Stupendious  
Ring, w<sup>ch</sup> must Reflect y<sup>e</sup> heat of y<sup>e</sup> Sun with  
great force, such as would burne our Earth  
to perfect Sterility. Where in y<sup>e</sup> world is so  
Manifest Indication of providence In a finall  
caus, as In that Composition of Saturne? I  
must therefore conclude, that ffor the occa=  
sion there, w<sup>ch</sup> wee know Not, and may differr  
much from ours, Saturne is not so frozen as  
they Imagin, but May be a comfortable land  
to those creatures, If any are, to Injoy it.

Wee have litle to say of Jupiter, there be=  
ing No Manifest difference, between that  
and our Earth, but in magnitude, the. 4.  
moons, and the times of their Revolutions  
all

all w<sup>ch</sup> being as they are, Inferr Nothing More then that variety posseseth y<sup>e</sup> world. but the periodicall turnes of y<sup>e</sup> satellites or Moons Compared with one & other, full In like proportion of distance from y<sup>e</sup> planet, as those of y<sup>e</sup> planet's from y<sup>e</sup> Sun, w<sup>ch</sup> argues a likeness of cause that is a voluble Ether w<sup>ch</sup> carry's them, & naturally is Slower in turnes tho Not in pace, by distance. And If Every planet & sub planet had its /originall\ motion apart, without dependance on Such Comon /or uniforme\ Cause, It is Not to be fancyed they should bring a celerity So neerly Calculated, but that y<sup>e</sup> neerest /might\ Some times be Slower, then y<sup>e</sup> order is. and /But\ so the late vacuists have Imagined, but what Ground let y<sup>e</sup> Indifferent Judg.

As to Mar's No discovery of Rotation, subplanet or vortex, so Reputed to be to y<sup>e</sup> Sun, as y<sup>e</sup> Moon to y<sup>e</sup> Earth.

As to Mars, there is yet less to be particularly observed of it, till Some farther discovery, If such may be hoped for, shew whither It Revolves on a Center or Not, or whither there be any rotation of any Etheriall Matter, or there be any air-spear about it or Not. of all w<sup>ch</sup> circumstances wee have no discovery and therefore at p<sup>r</sup>sent, p<sup>r</sup>sume there is None, but that y<sup>e</sup> planet is nude, & Revolves about y<sup>e</sup> Sun as y<sup>e</sup> moon & y<sup>e</sup> Satallit's Revolve about their Native planets.<sup>87</sup> There is a zone about mars, w<sup>ch</sup> may be accounted a perpetuall  
cloud

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<sup>87</sup> The moon revolves on its axis once per month and therefore always presents the same face to the Earth - this may be the 'systematic' feature which prompted RN to this comparison of Mars' relation to the Sun.

No certainty  
What y<sup>e</sup> Zone  
cross y<sup>e</sup> body of  
Mars is.

The Anomala  
of Mars, may be  
caused by y<sup>e</sup>  
Great vortexes  
of y<sup>e</sup> Earth &  
Jupiter, as per=  
turbung y<sup>e</sup> Cours  
of y<sup>e</sup> Ether there.

The Earth it  
Self, so well  
known to us, is  
ffull of Mysterys.

cloud, or sea, or what wee can fancy to  
caus such distinction, all w<sup>ch</sup> is but dream in  
Respect to knowledg. one thing of Mars is  
considerable, w<sup>ch</sup> is, that his revolutions are  
more disorderly the y<sup>e</sup> Rest, w<sup>ch</sup> makes it Styled  
the Ridle of Astronomy; and the artists cannot  
make their accounts without divers Medium  
allowances for Irregularity's, they Call anomala  
This May happen by reason of the Great vor=  
texes of y<sup>e</sup> Earth & Jupiter, between w<sup>ch</sup> Mars  
turnes, and they may possibly perturb y<sup>e</sup> Ether  
there, and be y<sup>e</sup> Caus of a less Steddy Motion then  
In other places, & so caus y<sup>e</sup> Anomala. I am  
sure it is as probable, as y<sup>e</sup> newfangled attrac=  
tion, notwithstanding all the Mathematicall  
apparatuses of it.

Now wee Come home to y<sup>e</sup> Next planet w<sup>ch</sup>  
is our Residence, and one would think If wee  
knew any thing, It should be the Condition of  
that. and so farr as bear's a due proportion  
with our faculty's, as being Neither too litle  
Nor too Great, wee cannot but perceive in y<sup>e</sup>  
various modes they Subsist in, however wee  
mistake In our Judgm'<sup>t</sup> of them; but what  
is out of that Strait limitt, wee understand  
as litle as wee doe of saturne or Jupiter.  
And are but tormented with our Insatiable  
curiosity, to know causes of things wee con=  
tinually Convers with, and Cannot be Satisfyed.

There are 3. Mistery's belong to the Earth,  
 1. Magnetisme, 2. the Cours of y<sup>e</sup> Moon, &  
 3. y<sup>e</sup> Tydes.

Of the Magnett  
 and its Wonder=  
 [f]ull, & Inscrutable  
 Effects.

As to the Mechanick caus of the Magnetick  
 operation's wee observe in y<sup>e</sup> Stone y<sup>t</sup> bears  
 that Name, and all Iron, so wonderfull and  
 peculiar as they are, I fear /it\ will Never be  
 knowne; becaus it Subsist's In /[sø?]\ a matter so  
 small, as perviates Brass, wood, Glass, &  
 what Not? as If Nothing were in y<sup>e</sup> way.  
 And D. Cartes never lost his labour In any  
 then more, then In forging Shapes, to ans<sup>r</sup>  
 that Inquiry, w<sup>ch</sup> cannot be proved, and  
 will Ever be denyed. Therefore It is a like  
 vanity to p<sup>r</sup>tend any particular solution  
 of magnetick operation's. But In generall  
 wee May Note Somewhat, tho Not other=  
 wise then as naturall history, so litle dare  
 wee attempt a solution. And litle are wee  
 helped by the late word In use, attraction; for  
 that is Idem per Idem.<sup>88</sup> and If one ask's  
 why one thing draw's another? It is answered  
 by a certein drawingness it hath. Nor Is the  
 Comon Electricity like it, for that is Nothing  
 unless Excited by a violent friction, w<sup>ch</sup> may  
 Caus y<sup>e</sup> Minuter Matter to turbinate; but  
 y<sup>e</sup> Magnet Never sleeps, tho In small things  
 It

Neither Electricity  
 gravity, or any  
 other action In y<sup>e</sup>  
 world like to Mag=  
 netisme, peculiar  
 to Iron.

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<sup>88</sup> i.e., 'the same for the same'

It vary's Sometimes; And Gravity is No less like to it, ffor that is unalterable, altho body's may be exposed to more Resistance so as not to Move, but yet their weight is added to y<sup>e</sup> body's y<sup>t</sup> Resist & Susteine them. And Every thing hath Gravity, Some few thing's, & those Irritated, Electricity; but onely Stone of one Sort, and Iron, Magnetisme. there= fore it stands by it self, and wee have No path from any knowne action In y<sup>e</sup> World to lead to a probable Conjecture what may be y<sup>e</sup> caus of it.

Seem's universally In y<sup>e</sup> Solar vor= tex, and to be that w<sup>ch</sup> librates all y<sup>e</sup> planets, to Respect y<sup>e</sup> Same fixt stars, as y<sup>e</sup> Earth y<sup>e</sup> North.

The Most generall thing wee know of Magnetisme is that it is, In our Solar World, universall, and Influenceth Every planet In it, the body of y<sup>e</sup> sun Excepted. this appears by the Same part of all y<sup>e</sup> planet's Respecting neerly y<sup>e</sup> Same part of y<sup>e</sup> heavens, & fixt Starrs. As the Earth hath a part alwais obverted towards the Starr called y<sup>e</sup> pole star, y<sup>e</sup> Moon y<sup>e</sup> like, And so of y<sup>e</sup> Rest, all w<sup>ch</sup> by y<sup>e</sup> Spotts or marks upon them, Appear Ever to be In y<sup>e</sup> same position. that is, Such part as Respect's the North, is found Ever to doe so. And this is the Constant property of y<sup>e</sup> Magnet, and Iron touched with it; that it obvert's one part, they call y<sup>e</sup> pole to y<sup>e</sup> North. And that this Regards y<sup>e</sup> heaven's, ffor neer the poles of y<sup>e</sup> Earth y<sup>e</sup> needle

No Exactness  
or Constancy In  
y<sup>e</sup> Magnett, but  
as other worldly  
Courses, full of  
variations.

Each Magnetick  
particle hath  
its turbo, or Sphear  
of activity, w<sup>ch</sup>  
upon Neer approach  
Joyne, & conforme  
posture (if free) with  
y<sup>e</sup> Great turbo of  
y<sup>e</sup> World.

Needle dippes, as they terme it, and by an  
Inclinatory frame points with Some Ele=  
vation Conformable with y<sup>e</sup> height of y<sup>e</sup> pole.  
But as ffor Mathematicall Exactness, a thing  
some are so fond off, Nothing like it is ffound  
In these observations of the Magnett; ffor y<sup>e</sup>  
Inclinatory stands neither true to y<sup>e</sup> pole  
Nor Constant to any place; and the horison=  
tall needle, doth Not point to y<sup>e</sup> pole of y<sup>e</sup>  
Earths vortex, but In severall places varys  
much from it, and those variations alter; And  
why Should wee with our trifles upon y<sup>e</sup> face of  
y<sup>e</sup> Earth, Expect Influences from y<sup>e</sup> wide world  
to work with mathematick rigor amongst us?

Another thing most wonderfull is, that Each  
Magnetick peice, hath a distict turbo, of the  
Subtile matter, whatever it is, about it. and When /as\  
other magnetable parts come within y<sup>e</sup> Sphear  
of it, they /all\ take the Same turbinous Quality & /ever\  
all-still Respecting y<sup>e</sup> poles, of each other & of  
y<sup>e</sup> Earth when discharged from them. for this rea=  
son, they Call y<sup>e</sup> magnet a terella,<sup>89</sup> And when  
pulverized-steel is Scattered about it, they are  
not drawne to y<sup>e</sup> body of it, but Cast Into a  
forme, Every dust having poles, and sorting  
themselves in proper Respect's as to North  
& South of Each other, w<sup>ch</sup> May be seen by  
y<sup>e</sup> Naked Eye. And Some say Cartesius had  
his

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<sup>89</sup> i.e., 'little earth'. William Gilbert (1544-1603) had made a small globe from magnetic rock and, by passing a compass over what he called the 'terella', he demonstrated his thesis that the earth was a large magnet. RN will have known Gilbert's *De Magnete ...*, 1600, and Gilbert is a likely source for much of RN's knowledge of magnetism and static electricity.

sceme of a terrella, p<sup>r</sup>esented In his works  
 ffrom this scattering of file dust about a Mag=  
 net, and y<sup>e</sup> forme it takes, Somewhat Resem=  
 bling his description. And It is very diverting to  
 observe when y<sup>e</sup> Magnet is absent and made  
 to approach, the file dust goes to work cocking  
 one upon another in strang thredds, w<sup>ch</sup> Makes  
 some Say, It is Each granule being In the  
 Sphear of activity of another, becomes a per=  
 fect Magnet it self, with y<sup>e</sup> poles, w<sup>ch</sup> ans<sup>r</sup>  
 Each other, as Great Magnetts doe, but I Need  
 not dwell on y<sup>e</sup> Wonder's of y<sup>e</sup> Magnet with  
 w<sup>ch</sup> books are Stufft; and touch onely so Much  
 as may make a litle Conjecture Not fasti=  
 dious.

Must act by Ma=  
 teriall Impuls,  
 It Qualifyes as  
 well as draws I=  
 =ron. as for at=  
 traction, wee know  
 Not what it  
 Means.

As first It seem's clear that it is Materi=  
 all Impuls, & Not attraction, unless that  
 word means Impuls, for wee are at a loss to  
 know what it means. If it were what wee  
 fancy of attraction, When wee hear y<sup>e</sup> word,  
 the force of it must weaken Gradually  
 by distance from y<sup>e</sup> stone or Iron. and If Matter  
 be made fine & light Enough for it to Move  
 It would draw it tho out of what wee call  
 y<sup>e</sup> Sphear of activity. but that is Not so ffar  
 out of a certein distance It moves Not y<sup>e</sup>  
 least thing, and at y<sup>e</sup> very Confines of y<sup>e</sup>  
 Sphear it actuates /& that with more suddeness & force\  
 Next It doth Not draw  
 its subject, but Inspires a like Quality in it.  
 And

and If attraction were y<sup>e</sup> vertue, It must have Effect by drawing, & Not by Qualifying. And lastly wee see heavy body's moved, w<sup>ch</sup> wee Can= not say is possible to be done by Impuls.

How y<sup>e</sup> planetts aspect y<sup>e</sup> fixed starrs, by Mag= netisme,

The magnetts doe Not carry a peculiar Subs= tance by way of Sphear about them, but find it w<sup>e</sup>ever it is, rea= dy In all parts of y<sup>e</sup> world.

The Caus seem's to be all over the solar vor= tex, ffor the plan of the Satellits & Ring of Saturne, so those of Jupiter, is Neer y<sup>e</sup> plan of our Zodiack, and that neer y<sup>e</sup> plan of our Eliptick. so that allowing as wee Must In all Naturall cases, some Irregular swer= ving's, the magnetisme of all y<sup>e</sup> planet's draws all toward's y<sup>e</sup> Same regions. the Macular of the sun, Move neer y<sup>e</sup> plan of y<sup>e</sup> Ecliptick, so the poles of y<sup>e</sup> Sun Must be neer artick & antartick And So farr as wee Can Judg by /from\ y<sup>e</sup> litle Magnetts wee Examine by, and y<sup>e</sup> Iron Magneticated by them; the matter that supply's y<sup>e</sup> Influence or activity, is in all places, and None can be found without it. It is Not possible y<sup>e</sup> Magnettt can carry a turbo with it of y<sup>e</sup> Same Stuff, but it works by y<sup>e</sup> Stuff it finds In all places. And as the sun planetts & subplanetts are all magnetts In their places, and point to y<sup>e</sup> North, so is Every frustrum of magnetick Stone, and magneticated Iron y<sup>t</sup> is found In y<sup>e</sup> World. And by the power's magnetick those Immens heaps of matter are tyed to their aspect, whereby wee, In particualr, have our chang of winter & Sumer so Steddily.



Y<sup>e</sup> active matter is  
Small beyond any  
wee know, and  
act's thro fire, &c.

May be Resolved  
by Supposing y<sup>e</sup>  
magnetick Mat=  
ter In a perpetu=  
all Current, thro  
y<sup>e</sup> World; and Iron  
or Iron stone, onely  
to obstruct that  
Current.

The actuating materiall is small, as hath  
bin say'd, but yet not In any Respect like  
to fire. ffor it operates thro fire, and Neither  
augment's, nor abates y<sup>e</sup> vigor of it, but In  
y<sup>e</sup> Same manner, as thro air mettall, Glass,  
or wood. ffrom whence In-ferr it is smaller  
then any thing Concerned In fire. ffor the force  
of fire, is by minute part's striking and so  
moving one and other. w<sup>ch</sup> argues some pro=  
portion between them, for a very small thing  
striking a very Great one, May Not Sepa=  
rate, or Excite any comparative celerity  
in it. ffor w<sup>ch</sup> reason. If fire were of parts  
(for Instance) as sand, and y<sup>e</sup> Combustible Mat=  
ter as the larg pebble, the agitation of y<sup>e</sup>  
one In y<sup>e</sup> Interstices of y<sup>e</sup> other, Minutatim  
would ~~never~~ /very hardly (without somewhat Els  
Interposing)\ bring the greater Into a con=  
formable agitation, with y<sup>e</sup> less, ~~nor~~ /as\ alter y<sup>e</sup>  
dispositions of it. but yet If wee Might Ima=  
gine a compound body lodging among these  
stones, w<sup>ch</sup> consisted of small fibres and Capilla=  
ry Interstices, capable of this matter to pass  
thro, but not easily or direct. but so as shall  
strike In y<sup>e</sup> passing. And farther wee sup=  
pose that this subtile matter is In a per=  
petuall Current, however It might pass thro  
the stones by y<sup>e</sup> Interstices without any effect  
as air might be supposed to pass gently  
thro; but If such body of more obstruction

Received

Received all the force united of so Much as  
 fell upon it; such body yt would Not be  
 dispersed, as by fire, yet Might be moved  
 by an united force. And yet Not Every bo=  
 dy In such case; becaus the composition  
 may allow free or strait passages. Nay Wee May  
 Suppose but one /sort or Species\ body in y<sup>e</sup> World capable  
 of such obstruction of y<sup>e</sup> subtile matter, and  
 that wee may call Iron. whither In y<sup>e</sup> Stone  
 or purged from stone, w<sup>ch</sup> is y<sup>e</sup> Comon Mettall.

An Image to ad=  
 umbrate how Such  
 action as of the  
 magnetick spheer  
 may Influence.

But Now to Continue these Imagination's  
 ffor Nothing of Nature can be understood y<sup>t</sup>  
 is Not Mentally at least, Reduced to sen=  
 sible magnitudes; let us conceive a bundle  
 of Glass tubes packed close together, each  
 of an Inch bore, and all opening Not ex=  
 actly but cheifly one way. And this plac't  
 In a current of water, In Such manner as  
 It May turne freely Every way. It is sure E=  
 nough, that this lump would not Rest till  
 all y<sup>e</sup> Cavity opened towards y<sup>e</sup> Stream, so as  
 y<sup>e</sup> Current might have y<sup>e</sup> least obstruction  
 by it. And If a spectator did Not know y<sup>e</sup>  
 fabrick of it, nor could discern any Current  
 and found y<sup>t</sup> let him turne it w<sup>ch</sup> way he  
 would one side would still be obverted y<sup>e</sup>  
 same way, he would Conclude, some attrac=  
 tive Influence drew it.

A Concept that the solar System is but as a part of some other world, as a planet onely, w<sup>ch</sup> hath currents & Influences universall, as May appear in So generally Magnetisme as Wee know possesseth us.

This concept fitts y<sup>e</sup> Magnet well Enough In some Respect's but Not in all, and others wee must Inquire. As If wee would know how all y<sup>e</sup> Solar planet's & sub-planetts are kept in continuall Identity of position towards y<sup>e</sup> North, how ever otherwise moving or turning round; wee May Imagin that there is a Current of this subtile Interstitiall Matter smaller then fire, and small to a degree, as Not to Move considerably such parts as Constitute fire. And this passeth thro the whole Eetheriall Sphear in a Cours from North to South /if such current be\ Whither /it\ hath a Cours thro other Sphear's or Not is Not reasonable to dispute, becaus wee find No Returnes In this but it is (to our Notice,) extending Even to y<sup>e</sup> orb of saturne, Extraordinary broad, If Not universal, & therefore must Come & goe without it. And to take away y<sup>e</sup> Strangeness of this, I throw In, a possibility that our sun with its attendance, and all y<sup>e</sup> fixt starrs wee know & what belongs to them, May constitute Some small particle, or planet, In a System of some other world, /w<sup>ch</sup>\ wee know Not [of?] Nature hath No limits, and as a /small\ vortex In y<sup>e</sup> /wide\ Sea /is to y<sup>e</sup> ocean it self et sic ad Infinitum<sup>90</sup>\ So May all y<sup>e</sup> knowne world be to what /I judg\ Nature hath to produce, when capacity's are /found\ apt ~~for it to~~ /to call for & Entertein it.

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<sup>90</sup> i.e., 'and thus to infinity'

The Incompa=  
tibility of y<sup>e</sup> op=  
posed poles, in  
severall Mag=  
nett's, or Needles  
an Inconceiva=  
ble Mistery.

Wee have fancied a mean's why a needle  
stands, being y<sup>e</sup> Same that holds /In constancy of aspect\  
y<sup>e</sup> whole  
family of y<sup>e</sup> sun, but what Causeth, the poles  
and Incompatibility of one with y<sup>e</sup> other, is a  
secret beyond y<sup>e</sup> bounds of all Conjecture. and it  
Is wonderfull to see with what suddenness the  
poles, that is the polar points of a Magnetick  
needle, start from y<sup>e</sup> opposite pole of a Magnet  
when brought towards it, the action resembles  
the passion of aversion & fear, more then the  
Influence of Subtile matter. This case makes y<sup>e</sup>  
Imagination of channells vaine, ffor If such were  
and so capable of the current of the generall  
stream of effluvia; why Not one way as well  
as another, & what matters w<sup>ch</sup> End is obver=  
ted to y<sup>e</sup> Curent? And what should make y<sup>e</sup> ori=  
fices that were not at first obverted to y<sup>e</sup> Cur=  
rent, Not onely Not Receiv it, but fly from it  
as from Infection, and So turne y<sup>e</sup> proper end.  
And If diver's bundles of channelled matter, are  
In y<sup>e</sup> Current's way, and neer one & other, that  
w<sup>ch</sup> settled, shall be peturbed by y<sup>e</sup> other, and  
according to y<sup>e</sup> end, or pole, approaching, either  
come to, or fly from it; and so goe beside y<sup>e</sup>  
current supposed to fix it there? these are  
Questions Not so Easily answered, as asked, &  
wee must goe farther for a possible Reconcilem't

A Concept that there is a double current from N. to S. E Cont, w<sup>ch</sup> may file by Each other & Not thro. And that Iron &c. have channells, y<sup>t</sup> either possessing p<sup>r</sup>vailes & obstructs y<sup>e</sup> other.

Whence May follow y<sup>e</sup> property of poles.

let us suppose then a double current, one passing from. N. to .S. of y<sup>e</sup> sunn's vortex, & y<sup>e</sup> other E. Contra. /from S. to N\ and these perpetually passing by Each other; W<sup>ch</sup> May possibly be, as sometimes appears In liquors, If one be very much heavier the y<sup>e</sup> other & be put in aloft, It shall pass downewards In fine thredds (w<sup>ch</sup> difference of Colours make visible) and that below rise In like manner, and so Continue to file thro Each other, till one hath gained y<sup>e</sup> lower & y<sup>e</sup> other y<sup>e</sup> upper Region, without Much Impediment to Each other's Movement What principle should actuate & maintaine Such current's In y<sup>e</sup> world, wee Cannot say. It is Enough If such may be, and Continue. Then it may be Imagined also, that this matter may pass by each other in y<sup>e</sup> open Ether, or thro body's so pervious as wee know almost Solid[s] are to magnetick vertue. but there May /also\ be channells, In w<sup>ch</sup> these body's meeting May obstruct Each other, and Not Move thro, at all but stick In them, and then If the current of one, be applyed with advantage, It turnes y<sup>e</sup> Scales, and then the matter of that Quarter Is set a going, and Maintaines the passage free to it self. Whereby Either the magnetick matter hath No passage, or It is in channells apart, the South and the North each from their proper

proper Region; Now If Iron, & Iron stone, Such as the magnet is, (that is, Iron disperst in Small lumps /&\ Intermixt with Earth) w<sup>ch</sup> is y<sup>e</sup> onely kind of body In the world, w<sup>ch</sup> y<sup>e</sup> ~~magnett~~ ~~concernes~~ /is susciptible of any\ magnetisme, Either acting or ~~suffering~~ Receiving Have peculiar channells such as may Restrein In their Cours the Magnetick current's; So as that ffrom y<sup>e</sup> S, &. from y<sup>e</sup> N. cannot pull a= g<sup>t</sup> Each other In y<sup>e</sup> Same channells. Then the polar vertue ~~that is a~~ Constant/-ly\ attendant /on\ of all Magnetisme, /is\ added, ffor y<sup>e</sup> needle, to Instance In what is most comon, is held as it were by cords In its place; And If put out, y<sup>e</sup> Current strikes on all part's to Reduce it.

Iron un<sup>r</sup>pared indifferent to both, but touched one or other possess= eth y<sup>e</sup> Channells, & so y<sup>t</sup> pole p<sup>r</sup>vailles.

If a needle be un<sup>r</sup>pared, that is Not Mag= netically touched. the current hath No In= fluce upon it Either way, becaus ffull of magnetick matter stagnant In it; but iff a current of northern matter be brought t<sup>o</sup> and applyed to it, then a Cours begin's of the Northerne current passing thro; and y<sup>e</sup> Same may also Make way ffor y<sup>e</sup> Southerne Current to pass; ffor y<sup>e</sup> Stream once determi= ned of some thro certein channells, y<sup>e</sup> other may start as being less resisted in other channells; but rather y<sup>e</sup> whole stream shall be Northern, and, If y<sup>e</sup> touch be contrary, Southerne,

An application  
to the fact.

q<sup>a</sup>

<figure of hand>

In Short this Imagination goes No further then a meer possibility, that a Current of subtilest matter, or of such at least as hath most Congruence with Iron, passeth from. N. to S. & E contra. And till somewhat hath determined the cours, it hath None thro Iron but thro y<sup>e</sup> stone all-ways. that the touch determines y<sup>e</sup> Cours, and then the polarity follows in y<sup>e</sup> body touch't. and If y<sup>e</sup> southern current p<sup>r</sup>vailes, y<sup>e</sup> Northerne of another Encloses it Not, for those are opposite. Wherefore, It seem's both Currents have place, In Every Magnetick body, and and when y<sup>e</sup> Northern current Issues at y<sup>e</sup> South pole of one, the southerne current venting by y<sup>e</sup> Northerne pole of another must being opposites be Incompatible. and thus /It seem's many If Not\ all the phenomena of y<sup>e</sup> Magnet May be Reconciled, to a Reasonable possibility.

If any one ask's, If I beleev this to be So? I ans<sup>r</sup> Not; ffor why should I have such an opinion to Credit a meer Guess, ag<sup>t</sup> such odds? but yet I say, A possibility may be maintained, and /let\ credulity /be\ apart.

Electricity is another strange Effect of minute matter, and Such a voucher ffor y<sup>e</sup> Attractive principle, that I shall bestow some note's upon it to shew It May be brought about Mechanically as well as Magnetick vertue.<sup>91</sup>

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<sup>91</sup> There is a single vertical line apparently striking out this paragraph - the first sentences on the next page can be read as replacing it.

It Might be proper here to persue this subject, and ffor the Small Resemblance bodys Electricall have with y<sup>e</sup> Magnet, examine them. but being Not well p<sup>r</sup>pared with observations, I deferre it to another place. And proceed In the Consideration of the world, and that w<sup>ch</sup> is peculiarly our /stage & \ dormitory alternately, The Earth /it Self<sup>92</sup>

Of the Globe of Earth, w<sup>ch</sup> is part dry & part humid or meer water.

The forme or levell of y<sup>e</sup> water w<sup>ch</sup> yeilds to pressure is for aught wee know, Exactly round or Ever tending to be so.

That hath three devisions, ffirst y<sup>e</sup> Globe it self so Called /or Solid part of it\ , w<sup>ch</sup> wee best know, being placed upon it with all advantage of view and Experimen't by w<sup>ch</sup> we Gather a Considerable Naturalll history of its surface, (ffor wee cannot penetrate to any considerable depth.) and of this Surface the too main distinctions are humid & Dry, or rather sea and land. the latter is a Conagulum, y<sup>e</sup> other fluid. And for that reason y<sup>e</sup> land is piled up In heaps, & lys with much unevenness, after the way of what is Called accidentall, ffor No part of Regularity appears to be-long to it. The Water from its loosness and fluidity, becomes uniformly mixt, and all /of it\ pressing, & all yeilding, as Inequality's happen, there is No  
Rest

---

<sup>92</sup> From 'it Self', the text continues in a different pen/ink.



rest but in ballance, that is In a Globu=  
lar forme, w<sup>ch</sup> is the utmost advantage  
of Compliance with Gravity. ffor Where y<sup>e</sup>  
matter is fallen Into such figure, it hath  
the least superficies.

A demonstration  
from y<sup>e</sup> Grand  
principle of Me=  
chanicks that  
water in y<sup>e</sup> air  
Must be round.

<diagram>

But Concerning rotundity of yeiding  
Matter pressed all about, I shall give one  
demonstration purely Mechanicall. W<sup>ch</sup>  
will Shew why ~~pui~~ bubbles & dropps must  
Ever be In y<sup>e</sup> open air round. And it is built  
on the universall rule of oppositions, that  
Quick & slow, that is time, is Equivalent  
to less & more, of Quantity or force. As If a  
body by yeilding from, protrudes another  
against y<sup>e</sup> force, If the latter Move Slower  
the ~~la~~ other hath advantage in power.  
As for Instance, lett the Matter In the ob=  
long forme, a.e. Reduced to Retundity fill  
y<sup>e</sup> Space c.d. being so Exquisitely Globular.  
the pressure is Equall on all parts, as at b.  
no less strong then at a. by ff.c.≥b.d.<sup>93</sup>  
and In the Coming Into a Globular forme  
the part a. comes to f. In y<sup>e</sup> Same time as  
b. goes to d. and b.d.≤a.f. therefore  
b. shall yeild to y<sup>e</sup> pressure at a. and No  
setlem't be till A.c.=c.d., y<sup>t</sup> is In a Globe.

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<sup>93</sup> The 'strict' inequality signs (< and >, meaning less/more than) were introduced by **Thomas Harriot in 1626**, and the 'unstrict' inequality signs (≤ and ≥, meaning equal to, or less/more than [this is the best I can do with this keyboard], with the horizontal line actually above the chevron, as is actually the case here) were introduced by **John Wallis in 1670**; both authors were cited by RN. As far as I can tell, though, RN generally uses the mathematical notation recommended in the prefatory materials to Isaac Barrow's *Lectiones opticae et geometricae*, London, 1669. (See note on f. 223r, below.)

If y<sup>e</sup> pressure be less at y<sup>e</sup> poles, y<sup>e</sup> Earth is oval, but that not discoverable becaus the perpendicular of weight to y<sup>e</sup> horizon holds.

<diagram>

Now If y<sup>e</sup> pressure be less at. a. as wee May suppose is y<sup>e</sup> Case at Either pole then It is possible y<sup>e</sup> sea take an ovall forme, whose longest diameter is Coincident with y<sup>e</sup> axis. ~~And yet No discovery Can be made of it, because the tendency of y<sup>e</sup> pressure is to y<sup>e</sup> Umbilick of y<sup>e</sup> ovall, whereby~~ And yet No discovery be made, becaus a strait line being a portion of y<sup>e</sup> axis takes y<sup>e</sup> place of center, so as the pressure is allowing square to y<sup>e</sup> horizon or tangent. as In the Ellips a.b. If the point. d. be prest so as to help to produce y<sup>t</sup> forme; I say the direction of it shall be a.d. square or perpendicular to y<sup>e</sup> tangent e.f. and Not to the umbilick, by d.g. and Supposing a like point. c. prest by b.c. the line. a.b. is the Centre line, In w<sup>ch</sup> the points are y<sup>e</sup> direction of the perpendiculars, from pressure at all points between c. & d. That the point. d. is so directed, is proved by y<sup>e</sup> tangent, a.f. and the region of the force without it. from whence all Impulses on. d. Gives the same direction and p<sup>r</sup>suming Imaginary part's to have the property of Regulars, the direction Must be by y<sup>e</sup> perpendicular. d.a. but as I Sayd  
this

this Matter admitt's of No Experiment,  
so litle is our knowledg of great things.

the Next devision  
is the air, of w<sup>ch</sup>  
a sphear Encom=  
passeth y<sup>e</sup> Globe  
of Earth

The air is Elastick  
& Compressible, and /  
shewed to be\  
distinguished from  
Aether, by y<sup>e</sup> penum=  
bra, In eclipses; and  
the pressure demi=  
nishing upwards, shews  
it ceaseth as the pro=  
portion Requires.

But besides this terraqueous Consistence of y<sup>e</sup>  
Globe, wee have a fluid of another Sort, w<sup>ch</sup>  
Incompasseth y<sup>e</sup> whole, without such Inter=  
ruptions of land, or ought solid, as part's y<sup>e</sup> Sea.  
And this is called y<sup>e</sup> Atmosphere, but I Shall  
choos to terme it y<sup>e</sup> air-sphere, as more En=  
glish and proper, becaus the substance of it.  
taken in a devided sence, is Called air. this  
is what wee know by breathing, the force of  
winds and other Experiments; w<sup>ch</sup> also Shew  
us that it is always Compressed, and when  
ever set free dilates, w<sup>ch</sup> is called y<sup>e</sup> Elasticity  
or spring of y<sup>e</sup> air; and it is Capable of farther  
Compressure; and Consequently Stronger spring.  
That y<sup>e</sup> air is a body distinct from Ether  
as Water is from air, saving onely that y<sup>e</sup>  
latter is Incompressible, appears by the  
Shaddow it gives on y<sup>e</sup> Moon In eclipses.  
That is called y<sup>e</sup> penumbra, and very dis=  
tinguishable from the Shaddow of y<sup>e</sup> Earth.  
And the proportion of it also appears Near[=  
ly Enough for our use; tho that is better  
demonstrated, by the strength of pressure  
In diver's heights; for the baroscope is  
suf=

Sufficient for that. as between the height of Salisbury Spire, & the pavement is In difference of the Mercury's Station about 1/10 Inch. as hath been approved by Repeated tryalls Made by the worthy M<sup>r</sup>. Windham. Then the progression of pressure abating, being I thinck, In duplicate proportion, or squares of the depth, readily gives the height of y<sup>e</sup> air Spheare. M<sup>r</sup>.Boyle hath found y<sup>e</sup> weight of air, and then, as the weight of Mercury is to that of air, space for space In content, so is the /cilinder\ ~~tube~~ of mercury In y<sup>e</sup> baroscope to the height of the air-Sphear. But More of this afterwards

the 3<sup>d</sup> devisions is  
Its vortex & attendant Moon. this  
Revolves slower  
than y<sup>e</sup> Earth, by  
y<sup>e</sup> rule of distance,  
for so y<sup>e</sup> Ether moves  
but y<sup>e</sup> air acquires  
y<sup>e</sup> diurnall Motion

It appears the Earth is Encompassed with a vortex, by the Moon's attendance, and Motion round it; w<sup>ch</sup> is Slower then y<sup>e</sup> diurnall, because so ffarr removed In place from y<sup>e</sup> Center, whereby, as the Solar planetts, for reasons given it is Retarded as to Revolutions, & performs one to, 28, of the Earth's Surface. This is the law of y<sup>e</sup> Ether, w<sup>ch</sup> I take to be y<sup>e</sup> principall In y<sup>e</sup> Movement. but as ffor the Air Sphear, it stick's So to y<sup>e</sup> Earth, by its weight, and /also\ clings together it self, that It hath acquired the diurnall Motion, and there is as Many revolution's In all heights

\*How y<sup>e</sup> diurnall  
 motion Gives us  
 our difference of  
 night & day with  
 other ordinary /comon\  
 In=  
 cidents, they are  
 ordinary & I pass  
 them by.

Of the Marine tydes,  
 difficult to account  
 for, by lack of  
 a Naturall history.  
 not clear whither  
 primarily the Sea  
 be highest or low=  
 est under y<sup>e</sup> Moon.  
 The latter say's S<sup>r</sup>  
 Is. N. who In that  
 crosses Cartesius  
 who say's, lowest  
 as [---?]/Com\prest by  
 mean's of coarctation

as at y<sup>e</sup> Surface of y<sup>e</sup> Earth. so that and the  
 air Sphear, make one Intire body;\*

In this generall way of discoursing of the  
 world, by w<sup>ch</sup> wee mean usually y<sup>e</sup> Globe of  
 Earth, ~~w<sup>ch</sup> is so to us~~, I shall p<sup>r</sup>sume to deal  
~~but~~ with but one Subject More, w<sup>ch</sup> is generall  
 & universall; & that is the Marine tydes.  
 They are an Evidence of some Connexion be=  
 tween y<sup>e</sup> Moon & y<sup>e</sup> Earth, becaus constantly  
 they keep times with it. but how that is,  
 wee are to Inquire. I am Not Satisfied, the  
 History of tydes is ffull Enough, to build a so=  
 lution upon, If wee would have satisfaction  
 concerning them, In that degree, as wee have  
 of the planetary System. Cartesius thincks  
 the sea sincks or subsides under y<sup>e</sup> Moon,  
 and assignes the caus, to coarctation be=  
 tween y<sup>e</sup> Earth and that; whereby y<sup>e</sup> air or  
 Ether being straitned in its cours Moves  
 faster, & so presseth y<sup>e</sup> yeilding Sea. S<sup>r</sup>. Is N.  
 Says the Contrary, that the Earth /Sea\ is higher  
 or Rising under y<sup>e</sup> Moon, and assignes y<sup>e</sup>  
 caus to attraction, w<sup>ch</sup> principle Granted  
 any thing may be Resolved, & Natural  
 philosophy is a most easy study Consisting  
 onely In the application of y<sup>e</sup> 'Word' attraction.  
 But

S<sup>r</sup>. I. N. Resolves  
y<sup>e</sup> tydes by attrac=  
tion of y<sup>e</sup> planets.

Impossible to be  
by attraction, for  
If so, It would be  
seen by y<sup>e</sup> Subtiler  
Barometers for y<sup>e</sup>  
air is a More yeil=  
ding body then y<sup>e</sup>  
Earth.

but he Resolves the tydes that way and Con=  
tends hard for it. I am Inclined to think  
that it is not needfull that one or other  
Should be So, as they Suppose. as I may Shew  
In the Mean time it seem's Impossible  
that the tydes Should be made Either by  
coarctation or by attraction, and one  
proof serves Equally to Confute both. and  
that is the Barometer. ffor If the Water  
of the sea be raised or compressed 2. or 3  
foot, the air-sphear thro w<sup>ch</sup> as y<sup>e</sup> Medium,  
y<sup>e</sup> force is Imparted, then y<sup>e</sup> air Must be  
raised or Compressed so Much More, as  
the Specifick weight of air, or the Eas of  
raising or Compressing it, is to that of y<sup>e</sup>  
sea water. And then there would be some  
token's of this action In y<sup>e</sup> barometer, Rising  
& falling as y<sup>e</sup> tydes, not y<sup>e</sup> least umbrage  
of w<sup>ch</sup>, or of any diurnall chang was ever  
suspected in it. They will say, perhaps, it  
is so litle, In y<sup>e</sup> proportion of y<sup>e</sup> Mercuriall  
length it is Not discernible; I ans<sup>r</sup>, that  
It would Make some offer, as the swelling  
& shrinking of y<sup>e</sup> Indicatory surface Shews  
In very litle tendency's to chang, before any  
actuell rising or falling of y<sup>e</sup> body so as by  
y<sup>e</sup> Index

\*<sup>94</sup>

by y<sup>e</sup> Index to appear. therefore Since wee find No signe of swelling or rising, & falling or subsiding of y<sup>e</sup> ~~bar~~ air-sphear In the Barometer [\* erased] I conclude there is really None at all, & so those Great Men's Inventions fare alike.

The Water's Can= not be actuated all In one Wave so that Every tide is raised from y<sup>e</sup> atlantick in 12= hours, but It Must break into Many waves, w<sup>ch</sup> play on a level as other waves doe.

The I think it Impossible, as they Suppose that the body of the sea, can take a semi diurnall movement, all at once; So that the Impression made in y<sup>e</sup> Atlantick, shall In 6. hours, or 12. make a Current In our channell; but It Must Needs be a longer tract of time to dispers y<sup>e</sup> Waters, And so, the highest tydes be after & Not at ffull & New Moon. But to leav off fin= ding fault with the accounts wee have I proceed to give what I can In their room.

The Tydes pro= ceed Mostly from disturbances of y<sup>e</sup> sea, from all sorts of Causes.

And that is In Short, that the Sea of y<sup>e</sup> world is like lesser body's of water, dis= turbed by all agitations against the Surface of it. the difference is cheifly in More and less. And to Make disturbance on y<sup>e</sup> Sea wee have trade winds and Hurricanes. of this wee may have a Resemblance, in any larg pool or Mere,  
when

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<sup>94</sup> Whatever was to have been noted has been abandoned, and the asterisk is erased from the text as shown.

Experiment of  
tides In a Comon  
lake or pool, w<sup>ch</sup>  
gives light to y<sup>e</sup>  
condition of Waters  
In y<sup>e</sup> World at larg.

When y<sup>e</sup> Winds agitate y<sup>e</sup> Surface, there  
Shall be Not onely the undulation's from  
the Immediate ripple of y<sup>e</sup> water, but also  
Grand heavings of the whole body, or In  
Great devisions of it. W<sup>ch</sup> is Not the Ime=  
diate Influence of y<sup>e</sup> winds or other dis=  
turbance, but Contracted or Growne out of  
them by Infinite ~~onee~~ Mixtures and Coa=  
lition's of the force. And If y<sup>e</sup> wind or what  
other caus Moves the water these Shall  
Continue after y<sup>e</sup> Surface is perfectly  
calme; All w<sup>ch</sup> any one may trye, that Will  
make a long chanel, <sup>95</sup> and that have a  
larg Receptacle at the End from y<sup>e</sup> Water.  
This set to y<sup>e</sup> water a very litle rising  
from y<sup>e</sup> level, the water shall be observed  
to pass along y<sup>e</sup> channell till y<sup>e</sup> Receptacle  
is full, and then y<sup>e</sup> water falling away  
It shall Empty againe; and this Continu=  
ing, ffor Many hours, And at Equall In=  
tervall, as all undulation's of water  
are Isocronous, w<sup>ch</sup> wee Shall shew and  
make other use of in proper place. these  
Grand undulation's ar Not of the whole  
body, but of Great devisions of it, Such  
as

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<sup>95</sup> RN was an enthusiastic digger of ponds, he published *A Discourse of Fish and Fish-Ponds [...]* Done by a Person of Honour, London, Printed for E. Curll, at the Dial and Bible against St. Dunstan's Church in Fleet-Street, 1713. He may well have carried out such an experiment.



as No gross view shall discover, and of so small rising that y<sup>e</sup> surface will appear Exquisitely Calme. but yet when this channell is applyed to y<sup>e</sup> Surface, the heavings will appear onely by the Current of the water to & fro. And If one would draw a picture of y<sup>e</sup> tydes, let that channell be Contracted Inwards from y<sup>e</sup> water, and be bent about, with various Inequality's & turnings, there is scarce a phenomenon of tyde Current's that would Not be con= figured there; to particularise In Many Instances of what is so well knowne will be loss of paper & Ink.

That y<sup>e</sup> Returnes are by Many Waves and Not al In one proved.

1. As to the Returnes of y<sup>e</sup> tides so periodi= cal, as ordinarily once In ~~six~~ /twelve\ hours, or neer it; I have to say, that If the whole aqueous Globe were Concerned all at once, as most fancy. that it is but one depres= Sure, & one rising of the sea, every 12. hour[s] It could Not make the dispatches to part[s] mediterrane, as creeks River's & channel[s?] So suddenly; and It is hard to Conceiv y<sup>t</sup> y<sup>e</sup> whole sea should heav & sett at once I choos to thinck that the heav's are broken Into many waves, as wee see i[n] A pool, where one heav answers another  
with

The Waves Must Rise & fall in neer Equall times, a y<sup>e</sup> sea would from Comon disturbances, Make tydes If No Moon were, but how regular frequent or Certein is hard to Say.

Water's Straitned at creek's & channells, shoot up farr above their driving force.

In y<sup>e</sup> polar region's tyde's wholly Irregular & Incertein, because In y<sup>e</sup> travell y<sup>e</sup> waves are disorderd.

with alternate troughs, and these, after the Nature of all pendulous Movements, (of w<sup>ch</sup> In fitt place) are /near\ Isocronous, ffrom the first to the last; So that If there were No Moon in y<sup>e</sup> Earth's vortex, I account that ffrom winds & Stormes onely, the sea would heav In divers waves, and So make tides In Rivers & channells; but more, and at other times less, bu/yet\ near Isocronous; but whither In 12. or 15 hours Returne it is hard to say. I onely add here that it is obvious how creek's & channells w<sup>ch</sup> coarctate y<sup>e</sup> Cours of y<sup>e</sup> water Entering with a vis Impressa, Make's y<sup>e</sup> Water Shoot up beyond y<sup>e</sup> originall Caus; And that an heav & Sett in y<sup>e</sup> Main Sea of 2. or 3 foot, w<sup>ch</sup> to y<sup>e</sup> Semidiameter, is Next to Nothing, may make a tide rise to 40. foot at Chepstow bridg.<sup>96</sup> Nor doe y<sup>e</sup> Irregularity of tides In some places, as In y<sup>e</sup> polar Regions, and Extraordinary regions positions of bay's & fretum's, Stay us. ffor first y<sup>e</sup> polar part's are Remote from y<sup>e</sup> trade winds w<sup>ch</sup> help to disturb y<sup>e</sup> sea, and to Give it a measure of direction; and y<sup>e</sup> water's broken In y<sup>e</sup> passage Come to run  
without

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<sup>96</sup> RN had been a regular visitor to the West Country with his brother on the Circuit, he had family relations in Bristol and elsewhere.

diver's port's have  
a 6. hours ebb &  
flood, & why.

The part y<sup>e</sup> Moon  
hath is In Equalli=  
zing or regula=  
ting y<sup>e</sup> Motion,  
but y<sup>e</sup> force is from  
y<sup>e</sup> pendulous Sea

without all rule of flux & ebb. [As?] I have  
an account from a traveller of Indubitable  
veracity,<sup>97</sup> who say's that beyond y<sup>e</sup> Cape  
Nord, In y<sup>e</sup> White sea before y<sup>e</sup> barr of Arch=  
angel, there are tides y<sup>t</sup> flow and Ebb Strongly,  
but Wholly Incertain. as for Scituations  
the harbours of pool and Southampton  
may serve for Instance. where y<sup>e</sup> tide Ebbs  
& flow's every six hours. so that when it  
is ebb at Hurst Castle It is flood at pool.  
the reason of w<sup>ch</sup> is, that y<sup>e</sup> Current In y<sup>e</sup>  
channel of y<sup>e</sup> Isle of Wight Set's Strong to  
the westward, y<sup>e</sup> Watter, s reason is, Shoots  
with a vis Impressa strait on, & doth Not  
suddenly make y<sup>e</sup> turne about to Enter y<sup>e</sup>  
Great channel, and that shoot of y<sup>e</sup> Water  
strait carry's it up to pool. And then y<sup>e</sup> flood  
abroad Coming from y<sup>e</sup> westward takes it  
out againe. And the Ebb current being stron=  
ger at low water, hath Greater force to  
Enter the fretum of pool, then when it  
is Midwater or higher.

But Now the main difficulty is to assigne  
what part the moon hath In this wonder=  
full phenomenon, And I can allow No  
more then, the Regulating and partly  
Conserving & partly Equalising y<sup>e</sup> Motion  
as

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<sup>97</sup> His brother Dudley North; Dudley's account of his journey to Archangel is quoted at length  
in *The Life of the Honourable Sir Dudley North, Knt., etc.* 1744, p. 8 ff.

As the weight of a clock [broke?] by the Wheels to a small force at y<sup>e</sup> pendulum, w<sup>ch</sup> it Can= not move when at Rest In y<sup>e</sup> perpendicular yet, being once swang from it, that litle force Shall supply the loss at Each vibration, and Conserve y<sup>e</sup> Motion, at a certein distance of oscillation. So I doe Not ascribe the origi= nall heaving motion of y<sup>e</sup> sea to y<sup>e</sup> Moon, (Not thincking any Influence from thence Can work so powerfully,) but to other accidents w<sup>ch</sup> by disturbing y<sup>e</sup> Surface create some hea= ving, then the litle Influence y<sup>e</sup> Moon May have as I may shew anon, May create a Conformity by Impeding one way, and pro= motion another, till the whole falls Into a correspondence In the alternations Made.

The Influence y<sup>e</sup> Moon hath is first, nearly that of cartesius; for y<sup>e</sup> whole Ether moving, y<sup>e</sup> Moon/s\ body Not yeild= ing as water doth, may com= press y<sup>e</sup> water a very Small Matter.

There are two way's by w<sup>ch</sup> y<sup>e</sup> Moon may have Influence on y<sup>e</sup> body of y<sup>e</sup> Sea, one is Nearly that of Cartesius; as when y<sup>e</sup> Earth Rolls with its Surface uner y<sup>e</sup> Moon, The heavenly Matter may be hindred by y<sup>e</sup> Moon from giv so Con= formable a movement, as when No such obstacle is there; As In a Comon Whirlepool of water, If a ~~round~~ Mass of wood swam at distance, an a small parcell Neerer y<sup>e</sup> center, and Swifter; it is No difficult thing

Note,  
 [puting?] water out  
 of levell, is done  
 with  
 y<sup>e</sup> least force. as  
 they  
 say No String Can  
 be perfectly strait,  
 but Gravity will Crook  
 it Somewhat.

<diagram in pencil>

2.

By disabling Gra=  
 vitation, In the  
 part under y<sup>e</sup>  
 moon, by friction  
 or Impedement of  
 y<sup>e</sup> Moon's body to y<sup>e</sup>  
 Influence in w<sup>ch</sup> it  
 is Resident.

thing to affirme that the Cours of the Smal[l]  
 peice passing under y<sup>e</sup> Greater Should be a  
 litle crooked or Bowed, from y<sup>e</sup> perfect orb  
 as it describes when In other parts. If it  
 be sayd that this, If any thing, Is very Incon=  
 siderable; I admitt it; ffor otherwise, It Must  
 appear by a diurnall chang In y<sup>e</sup> baromete[r]  
 And /It is Not\ the Motion of the Sea, but onely a  
 Regula[=]  
 tion is from it. another Influence, May be b[y]  
 disabling Gravitation In that part y<sup>t</sup> Is un=  
 der the Moon, but by No other Means then  
 that wee Call friction. As If a less cillinder  
 a.b.c.d. were put within on Somewhat  
 larger, A.B.C.D. and the Intervall betwixt  
 them filled with Mercury, or other Gravitating  
 fluid. The weight at the bottom, is Not so  
 great, and the Mercury hath Not so Much  
 force to discend, as when In a body free &  
 open; ffor the Rubbing ag<sup>t</sup> the sides of the In=  
 ward and outward Cilinder, deteins y<sup>e</sup> body  
 and is to be subtracted from its Gravity, as  
 liquors in very small tubes Shall hang &  
 Not discend at all. Now as the Intervall Is  
 Inlarged, so the Impediment by friction is  
 less; Suppose y<sup>e</sup> Inner Cilinder to be Reduce[d]  
 to y<sup>e</sup> Globule, E. so much superficies as it  
 hath, is So Much friction, to disable y<sup>e</sup> Gravit[y]  
 at

inc. depre[ss?].  
ye other [....?]<sup>98</sup>

In a Capillary  
[t]ube the whole  
[G]ravity of a li=  
[q]uor is disabled  
[b]y ye friction.

No Other means can  
[b]e thought on but  
[o]ne of these, for ye  
Moon to affect, or  
be connected in  
[m]otion with ye Sea

at c.d. This Now is ye Case of the moon,  
w<sup>ch</sup> having a spacious superficies, and Not  
very farr from ye Earth, May Make ye pres=  
sure on y<sup>t</sup> side of ye Earth less then otherwise  
It would be; If wee Reflect on a Capillary  
tube. If ye force of Gravity, such as works upon  
Comon liquors, have No access, but, thro ye  
narrow capacity of that hollow, it is almost  
lost, as Experiments of liquor Insinuating  
Into & hanging in them shew; and thence  
wee Must Inferr as before, that Every Solid  
of what-forme-soever it be, that ye force of  
Gravity must pass, takes from it In Tanto<sup>99</sup>  
as ye sides of ye tube doe almost In toto.  
And Consequently ye Moon must hinder  
the Gravitation of ye Sea under it, or  
nearly so, whereby it Must be disposed  
to Heave. ffor ye sea yeilds, and ye force  
will act upon that, rather then Remove  
ye whole Earth, & atmsphear all at once.  
the rather becaus ye Moon is Much less  
then ye Earth. These two way's, one by  
coarctation of ye Interrmediate space, & ye  
other by disabling Gravity, one May Imagin  
how ye Moon May Mechanically Influence  
ye Surface of ye Sea, and I know No other  
possible mean's for it. As for attraction we[e]  
deal Not In such Imaginary wares.

<sup>98</sup> Another note to himself (rather than a note to the text), also in tiny script.

<sup>99</sup> i.e., 'occasionally, from time to time'

That of friction  
chosen, It agrees with y<sup>e</sup> Seas  
heaving, & not  
sinking under  
y<sup>e</sup> Moon.

Note

but yet, a force  
y<sup>t</sup> presseth downe  
as well as raising  
maintaines y<sup>e</sup>  
action; for If it  
follow y<sup>e</sup> Motion  
one way or  
other, as a pendulum,  
it keeps  
it going.

If No tides were  
no Influence of y<sup>e</sup>  
Moon, without o<sup>r</sup>  
ther help would  
rais them, at least  
Not In Many years  
but being raised  
keeps them going.

Of these two way's, I choos y<sup>e</sup> latter, w<sup>ch</sup>  
declines D. Cartes, & agrees, as to y<sup>e</sup> fact,  
with S<sup>r</sup>. Is. Newton. ffor I doe Not Conceiv  
any great use of y<sup>e</sup> former as to tydes. ffor  
supposing y<sup>e</sup> whole vortex, with y<sup>e</sup> Globe of  
Earth & moon, having obtained a Regular  
and uniforme movement, and Nothing vio=  
lent pass between, the coartation hath No  
Effect, or most Inconsiderable, if any; &  
I think of y<sup>e</sup> two rather None at all. the  
failing of Cartesius was, In conceiving  
as If a Current passed between y<sup>e</sup> Earth  
and Moon; and If so, It is manifest y<sup>e</sup> Co=  
arctation must make a pressure, and  
bear downe y<sup>e</sup> Surface of y<sup>e</sup> Sea under y<sup>e</sup>  
Moon; w<sup>ch</sup>, S<sup>r</sup>. Is. N. say's, is Not y<sup>e</sup> Case, for y<sup>e</sup>  
Sea heav's under y<sup>e</sup> Moon. But y<sup>e</sup> other  
case of Gravity Impeded, It is proved by Expe=  
timent in less cases, and must have Effect  
In greater, according as y<sup>e</sup> Ingredient's  
beare proportion one to y<sup>e</sup> other.

If wee are allowed to Imagin, that the  
Surface of y<sup>e</sup> sea were once Exquisitely le=  
vel, and Not y<sup>e</sup> least disturbance or heav  
upon it. And the Moon performed its usuall  
orbes, I doubdt much If this defection of  
y<sup>e</sup> Gravity would In one Revolution make  
any

The Winds & hur=  
ricanes coming in  
aid, would soon  
rais tides to what  
they are.

Note.

In short so pendu=  
lous a body as levell  
water, must feel  
Every, Even y<sup>e</sup> least  
force can fall on it

Water will Not be  
disturbed all at  
once, but propa=  
gates y<sup>e</sup> disturbances  
by breaking Into  
waves.

Chang as would appear by tydes upon y<sup>e</sup>  
Coast, No more then a clock weight  
could set its owne pendulum to work; but  
In process of time, such heaving and tydes  
would Grow up, Especially If y<sup>e</sup> winds &  
Hurricanes came In aid, by disturbing  
the Seas Repose. It is observable that y<sup>e</sup>  
trade winds are from E. to. W. w<sup>ch</sup> is accor=  
ding to y<sup>e</sup> Moons Cours, and operating y<sup>e</sup>  
same way. All these causes cooperating  
must needs, as y<sup>e</sup> Moon passeth, and once  
having raised a wave or made y<sup>e</sup> Smal=  
lest heav upon the sea's surface, carry it  
on and Increas it till adequate, as y<sup>e</sup>  
oscillations of a pedulum will be to y<sup>e</sup>  
weight y<sup>t</sup> continues them.

It is a propery of a watery Surface, When  
a wave is raised In one place, for it, by  
subsiding, to rais the like in a conti=  
nued Cours along y<sup>e</sup> Surface Every way,  
w<sup>ch</sup> is a knowne Consequence of every  
motion of y<sup>e</sup> Water. Then Considering the  
diurnall Motion of y<sup>e</sup> earth or moon  
is Swift, wee cannot Conceiv the wave  
made or occasioned, or Continued by y<sup>e</sup>  
moon's Cours to be universall, or all  
over



Therefore, y<sup>e</sup> tides  
cannot be by  
y<sup>e</sup> opposite parts of  
the Globe heaving  
& sinking together  
tho, y<sup>e</sup> waves bro=  
ken Into many  
as they are, rise &  
fall in 6 hours

over the semiglobe at once ffor y<sup>e</sup> rising  
or heaving of so great a body, & so slow  
(If so great) must make longer Ontervalls  
of Returne then the diurnall time will  
allow. As If wee Could suppose the water  
of y<sup>e</sup> whole Globe as M<sup>r</sup>. D. Cartes & S<sup>r</sup>. Is. N  
suppose, to be put into an undulatory  
Motion, so that y<sup>e</sup> water heav's, and shrink[s]  
at y<sup>e</sup> opposite points together, & So Conti=  
nuing alternatively. It cannot be thought  
this could so Swing, In 12. hours Space.  
but would take a week, or longer. And  
If In a pool of water one Should observe  
y<sup>e</sup> Magnitude of y<sup>e</sup> undulating opaces;  
and the time of their Returnes, this trans=  
ferred to y<sup>e</sup> Globe of Earth, and so Com=  
pared, by y<sup>e</sup> Rule of proportion, would Shew  
a length of time to o<sup>r</sup> Great surprise. but  
I doe but aim, & Not Calculate. I there=  
fore Conclude, and with No Small assurance  
that, the aqueous part of y<sup>e</sup> Globe, is by  
y<sup>e</sup> crisis of y<sup>e</sup> Moon, broke into waves, such  
as by y<sup>e</sup> Rule of Returnes, or Watery oscil[=  
lation's Shall ans<sup>r</sup> the diurnall cours  
of the Moon. So that the heav or flood  
be 12. hours, and the subsiding or Ebb  
be In like time, to Compleat y<sup>e</sup> Cours

&

Note  
 a wave may pass  
 with y<sup>e</sup> Moon, Whi=  
 ther It be upon y<sup>e</sup>  
 Rise or fall;

Water hath os=  
 cillation's accor=  
 ding to the Sub=  
 stance, and No=  
 thing will Make  
 it take Swifter  
 or Slower oscilla=  
 tion's, but Imme=  
 diate violence  
 y<sup>t</sup> over rules y<sup>e</sup>  
 cours.

and then y<sup>e</sup> Moon Returnes, to ffavour y<sup>e</sup>  
 next heav, or flood. And so y<sup>e</sup> pendulous  
 undulation's are kept going for Ever.  
 Wee are too litle ever to discover Into how  
 many of these waves y<sup>e</sup> sea is broken, wee  
 can onely Conclude, they are so many as  
 that one shall be of such Extent, whose  
 oscillations shall gœe be of 12. &. 12 hours.  
 ffor such is y<sup>e</sup> Nature of water, Resembling  
 y<sup>e</sup> movements of pendulous body's; the Waves  
 will accelerate or Retard In their Move=  
 ment, according to y<sup>e</sup> bulk of them, as y<sup>e</sup>  
 pendulums are In length & weight, and  
 No force applyed shall make them, without  
 Such chang hasten or slacken their pace  
 by w<sup>ch</sup> wee have from such Movements our  
 best Regulation's of time. therefore of Ne=  
 cessity y<sup>e</sup> body of water, y<sup>t</sup> Makes y<sup>e</sup> tide  
 waves, must be In Magnitude, So Cast  
 as to Correspond the Returnes of y<sup>e</sup> Moon.  
 ffor No Naturall Influence, I mean, y<sup>t</sup> is  
 ordinary and Not over violent, will work  
 y<sup>e</sup> Water Into Quicker Returnes, If it be  
 parcelled In Greater Magnitudes, then  
 Nature assignes to Returnes In y<sup>t</sup> time.

Here

The Moons age  
discovers high  
& low water in  
Most places, Not  
Exactly, but  
nearly.

great Irregula=  
rity's or anomala  
In tydes; as shall  
happen flood,  
neap, very high  
or low, unac=  
countably.

Here is a solution of that Grand probleme  
why the tyds allwais hold time with y<sup>e</sup>  
Moon? It is Not demanded, that y<sup>e</sup> tide  
Should Ebb & flow, with y<sup>e</sup> Moon's pas=  
sage by us. ffor that is according as sci=  
tuation of places, with Respect to the  
coming of y<sup>e</sup> wave prooves. In some y<sup>e</sup>  
high water shall be at 8, In others  
at 9. and so 11. &c. when at y<sup>e</sup> Same  
day, y<sup>e</sup> Moon Shall Come to south at. 12.  
but Every where, (Except y<sup>e</sup> Skirtings of  
y<sup>e</sup> Zodiack towards y<sup>e</sup> poles,) at the same  
time of y<sup>e</sup> moon, is y<sup>e</sup> flood & Ebb at that  
place, and this continues, whereby know=  
ing y<sup>e</sup> moon's age, the time of high or  
low water, is knowne in all ports of  
usuall trade. But yet this is farr from  
being very Exact, and how cann it be  
So Expected, when aet accident's upon  
y<sup>e</sup> Earth's face, as winds Either favoring  
or opposing y<sup>e</sup> cours, may and doe happen  
to vary times & measures of tydes; w<sup>ch</sup>  
Makes y<sup>e</sup> Marriner's y<sup>t</sup> observe them ad=  
mire, how such Early of late, high flood  
or /low\ Neap tydes happen, & It is Not strang  
when they are Ignorant of these Extra=  
-ordinary

=ordinary accidents, but the Cours of y<sup>e</sup> Moon, y<sup>e</sup> ordinary Caus of the time of the Returnes, by y<sup>e</sup> Mean's I have Noted, Re=duceth all to y<sup>e</sup> Cours againe. I Cannot p<sup>r</sup>tend to Such history of y<sup>e</sup> Moon's motion & tides, /as\ to make a concordance between them in Every thing. ~~If wee doe~~ /It is Enough\ Not /to\ Romance in our prin=

ciples; and In gross /I must say\ they agree with y<sup>e</sup> Events. &

If some Incidents are hard to Resolve It is no Wonder, becaus Many circumstances In thing's of that magnitude & distance from us may caus deviation's, or, to our thincking, anomala, w<sup>ch</sup> wee cannot discover or know. That Noble Resolve of Copernicus, is Never to be forgot, who argued y<sup>e</sup> motion of the planet's according to y<sup>e</sup> systeme that bears his Name; by w<sup>ch</sup> the apparent light ought to have deminisht In View, In proportion to their Elongation, but did Not so, and In all distances, appeared of y<sup>e</sup> Same Mag=

nitude, yet his reason held him to what was so Reasonable, and afterwards the Invention of telescopes, w<sup>ch</sup> he Never lived to know, Justified him, and demonstrated his systeme true. If it had bin urged to him, how doe you Resolve y<sup>e</sup> apparent magnitudes of y<sup>e</sup> planet's to be y<sup>e</sup> Same

while

The discovery's of Copernicus were so reason=able, were Not layd aside, be=caus some phe=nomena did Not Quadrate With them.

while you send them so farr off, & then  
 so Near againe? he Must have silently  
 winked an ans<sup>r</sup>. Not having any one to  
 Reply that would [refell?] y<sup>e</sup> Caption, and yet  
 beleevd himself In y<sup>e</sup> right, and y<sup>t</sup> time  
 Might, as it did, discover a solution. and So  
 bear y<sup>e</sup> derision of them, who thinck all  
 things are to stand & fall by disputation,  
 and have No Notion of a Judgment above  
 caption.

This may look like a vaine apology for  
 not obviating all objections, and /not\ applying all  
 Incidents of y<sup>e</sup> Moon and tides to this hypo=  
 thesis, w<sup>ch</sup> I may owne My self Not able to  
 doe, and yet thinck I may be in y<sup>e</sup> Right,  
 as to the main; and after y<sup>e</sup> Example of  
 y<sup>e</sup> Great Copernicus, Referr Much to futur  
 discoverys, or to y<sup>e</sup> p<sup>r</sup>sent Incognita w<sup>ch</sup> Will  
 not be a ffew. Nor doe I thinck it is an-ans<sup>r</sup> /a  
 confutation of\  
 to any hypothesis, that It will Not answe[r]  
 all Circumstances; If y<sup>e</sup> principles are un=  
 doubtdly true, and the application /In generall\ Con=  
 forme to y<sup>e</sup> Nature; ~~So Much~~ /wee must allow a good Share\  
 of Ignorance to  
 will be Intermixt with knowledg; After this  
 I need Not /make any\ steps farther In this theory, but /  
 ex  
 yet /abundanty<sup>100</sup> &\, as an Essayist onely I will venture a  
 litle  
 farther.

---

<sup>100</sup> 'ex abundante' = out of the abundance

The cheif phenomena of tydes are, that at New & full Moon y<sup>e</sup> tydes are highest, and at y<sup>e</sup> Quadratures most Neap, and so at spring and fall, the high tyds are Much More Redundant then at Mids<sup>o</sup>. & Christmas. Sr Is N hath fitted his attractive power's of y<sup>e</sup> Sun as well as of y<sup>e</sup> Moon, to Resolve this; ffor first when y<sup>e</sup> sun & moon Joyne attractive forces; as at a Conjunction, or draw severall ways is at opposition; the compliance of y<sup>e</sup> Water is Greater, then y<sup>e</sup> Sun & Moon, as at the Quadratures doe Not Cooperate; but yet this is all Nudum pactum,<sup>101</sup> & p<sup>r</sup>carious In the very principle, therefore Say No More of it.

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<sup>101</sup> i.e., 'a naked promise', i.e., a contract made without confirmation, a legal term.



Not being satisfied with those generall hints  
 I have given, in my discours of ye Worlds fframe,  
 Relating to an hypothesis ffor solving the ordi-  
 nary but universal phenomenon of Gravity,  
 I Resume the matter in a particular discours,  
 becaus I am ffully possest of ye clearly plain-  
 ness of it, and fear, as it hath Escap't being  
 Received ffrom an better hand, so it will from  
 mine, unless I doe somewt inlarg upon ye  
 Subject, wherein I am not without hope  
 to Succed in ye discharg of my owne thoughts  
 so well, to Make some impression upon others  
 ffor I cannot fforbear being zealous to pro-  
 mote the abolition of such Wonder as this  
 hath bin to ye vertuosi, by ye Explaining the  
 caus of this most universall action of body  
 w<sup>ch</sup> wee minutely see & ffeel, in o<sup>r</sup>Selves  
 as well as in other body's; it is certeinly  
 the Most Noble principle in Nature, the true  
 anima Mundi,<sup>103</sup> without w<sup>ch</sup> ye univers would  
 be lost & ye whole frame of this beautifull  
 World perish; And ffarther I cannot Shake of  
 a perwasion that I may transmitt my reason's  
 to paper, & from thence to ye Minds of the  
 unprjudic't, the rather being clear from ye im-  
 putation of ffondness, being no inventor but in  
 this an arguer onely.

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<sup>102</sup> slightly smaller paper size (shorter) from now on, but good and opaque as the previous section ...

<sup>103</sup> i.e., 'the world soul', a concept derived from Platonic thought. Note that RN offers here not a metaphysical force to explain the operation of the cosmos, but a material one, so *anima mundi* corresponds only by analogy to his system of the etherial vortex. As is clear, he believes that Newtonian 'attraction' is still embedded in the mystery of an animate universe. See note on fol. 159r in BL Add MS 32545.



To Hint shortly My Method, I shall use these heads. 1. To shew the measures, of this fforce. 2. the Manner of y<sup>e</sup> action. 3. the Relation it hath to the sun & planets. 4. Answer objections. 5. shew w<sup>t</sup> other hypothes I have met with. 6. propose some Question's upon y<sup>e</sup> Subject.

1. It being p<sup>r</sup>emised that the celestiall ocean is perpetually vorticated about y<sup>e</sup> Sun, and part subordinately about y<sup>e</sup> planet's, or some of them, The consequence of w<sup>ch</sup> is an universall action of y<sup>e</sup> whole to Receed by tangent lines from y<sup>e</sup> Severall center's, and that produceth in y<sup>e</sup> pleni- tudes of thing's, an actuall Recess of the stronger, and access to y<sup>e</sup> center of y<sup>e</sup> weaker body's, as y<sup>e</sup> Effect of opposition Now it is My buissness to shew by w<sup>t</sup> ~~fforee~~ Rules & Measures this fforce is Governed. W<sup>ch</sup> are the Quantity figure & Rapidity of the severall body's Concerned.

1. It will be clear that of body's w<sup>ch</sup> Move in fluido, where y<sup>e</sup> force is according to the Quantity, and the Resistance according to y<sup>e</sup> Superficies, Greater body's have y<sup>e</sup> advantage of y<sup>e</sup> less, & will Retain their fforce longer. ffor such have a less proportion of superficies then the smaller, w<sup>ch</sup> is demonstrated by y<sup>e</sup> pratical observation of 8 comon dice. one whereof hath to y<sup>e</sup> Substance of 1:6. sides. put all 8. together. & Make y<sup>e</sup> next Cube. and you will have but. 24. of those sides outward to y<sup>e</sup> Substance of. 8. which is as 1. to. 3. Just half y<sup>e</sup> measure of Resistance w<sup>ch</sup> one dy hath, that being as. 1. to. 6. So that it is plaine Great body's have more force of perseverance in y<sup>e</sup> tangent Recess then the More minute.

2. Next y<sup>e</sup> figure Makes the like difference ffor the Globular is y<sup>e</sup> Most Compact & Comprehensive figure that can be. this is proved by reason & Experience, but cannot be demonstrated without the Quadrature of y<sup>e</sup> Circle. ffor Reason I give y<sup>e</sup> view of y<sup>e</sup> proposition in Euclid. of triangles upon y<sup>e</sup> Same base between. 2. parrallels, w<sup>ch</sup> are all Equall. but y<sup>e</sup> Equilaterall hath shortest sides, & y<sup>t</sup> is nearest to a Sphere. ffor Experience take that of a Drop of water in y<sup>e</sup> aire w<sup>ch</sup> is always round

<diagram>

Because being prest by y<sup>e</sup> air on all sides it gives way till it ffalls into y<sup>t</sup> figure, & then It can yeild room no more. So likewise those body's or parts of Matter, w<sup>ch</sup> are Globular if any Such be, or inclining to it, have more fforce to Receed then other's, and in proportion to the declination of y<sup>e</sup> figure.

3. But that w<sup>ch</sup> is Most Considerable is the Rapidity of y<sup>e</sup> Motion, w<sup>ch</sup> Compared with oure<sup>104</sup> common action's is as Swift as wee can well imagine possible, w<sup>ch</sup> hath bin Made appear by those who have Cal=culated the Swiftness at y<sup>e</sup> Earth's Surface by hours, & minutes. and it is in Short Such as that of an arrow out of a Bow. but wee are not sensible of it, being carried in it like saylor's in a ship, but could some almighty power stop us, but a minute hills, trees, or houses, would beat out o<sup>r</sup> braines. And when this force operates in y<sup>e</sup> perpendicualar, wee see a considerable Effect of it, as in y<sup>e</sup> force of weight, Sufficient to reconcile them two in point of measure.

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<sup>104</sup> the 'e' has been washed out.

2. I am next to take notice of the manner of this action, w<sup>ch</sup> depends upon y<sup>e</sup> consideration of w<sup>t</sup> I have say'd in y<sup>e</sup> former part concerning y<sup>e</sup> motion of fluids, and that depends upon the law's of motion, w<sup>ch</sup> are universall, & governe every accident of body, be it never so great or Small. The celestiall Matter being fluid Must have a perpetuall intestine agitation of its parts, all of w<sup>ch</sup> together are imbued with y<sup>e</sup> vorticall progression, the vertue of w<sup>ch</sup> (to use metaforicall Expression's) is imprest upon Every part. so that when one part strikes another so as, by y<sup>e</sup> law's of Motion it should give it a direction towards the center, there is a Resistance, Not onely by y<sup>e</sup> bulk of y<sup>e</sup> part striken, but also that force of progression acquired, w<sup>ch</sup> tends in a strait line; that is both the part, an a force acquired Contrary, or somewhat opposite, to that of y<sup>e</sup> impulses, w<sup>ch</sup> together are More powerfull then the part without that force would be. Now if the body's thus Concerned were Equall in other Respect's this turnes y<sup>e</sup> Scales, & give y<sup>e</sup> p<sup>r</sup>valence to y<sup>e</sup> part impelled; the like is to be say'd of the impulses w<sup>ch</sup> give a direction ffrom y<sup>e</sup> center a Small part, with y<sup>e</sup> adjunct of y<sup>e</sup> tangent Recess Shall doe More the without it, and in Sume the fforce y<sup>t</sup> operates ffrom the center, hath the tangent Recess to increas it, and the force y<sup>t</sup> operates to y<sup>e</sup> center, w<sup>ch</sup> ceteris paribus are Equal hath the same to hinder it.

The Consequence off all this is, that /this\ infinit mixture of Motion w<sup>ch</sup> is in a fluid, impregnated with y<sup>e</sup> tangent Recess, y<sup>t</sup> is destributed to y<sup>e</sup> part's according to their severall Capacity's of force before hinted, should produce a generall separation of them, Not unlike to y<sup>e</sup> Comon ffermenting of liquors, whereof some part's are dispatcht upwards, & others the contrary way, untill the mixture be so uniforme that no farther separation is Made ffor y<sup>e</sup> Smaller & Most angular parts have great impediment ag<sup>t</sup> moving from y<sup>e</sup> center because y<sup>e</sup> greater part's must be Removed, but small impediment in Moving downwards, because the greater give way of themselves. and the greater can displace y<sup>e</sup> less, & weaker, w<sup>ch</sup> cannot hinder them ffrom advancing. Thus the whole sphear comes to be Establish't so that the parts of greatest force are towards the circumference, and those of y<sup>e</sup> least fforce towards y<sup>e</sup> Center and intermediate Space ffilled with such in all degrees w<sup>ch</sup> are of force according to the distance, and so y<sup>e</sup> whole is Economised & ballanc't with it self. If an almighty power Could bring downe a mass of Matter ffrom y<sup>e</sup> Moon, or Some other more Remote part of our vortex, wee should /find\ that as much disposed to Move upwards againe [as]

When our mortality's happen to be Removed  
 a litle higher then ordinary, or way is Made  
 under us, wee are disposed to ffall downe;  
 till some Solid obstruct's us from falling lower.  
 And if Some almighty power Would make  
 way to y<sup>e</sup> center, I scarce beleev any body  
 would fall so low ffrom y<sup>e</sup> top of y<sup>e</sup> Earth  
 but at length come at Matter of Equall force  
 with it self and there be ballanc't, & Move  
 No farther. These are Certain Consequences  
 from probable supposition's of the Mundane  
 State, w<sup>ch</sup> wee have no means to Experiment,  
 but have good Reason to inferr. And if those  
 are So strong that no ingenuous person can  
 doubdt or will deny, wee are justified in Ma=  
 king use of them. As none can deny that the  
 Ether is a fluid, & that it Consist's of part's  
 of almost infinite different shapes & demensions  
 and that the whole moves vortically. Then by  
 the law's of Motion, (In y<sup>e</sup> application of w<sup>ch</sup>  
 I have, to obviate cavill, and be more plaine,  
 bin very particular,) upon w<sup>ch</sup> all accidents  
 depend, these Effect's Must shew themselves.

I must further observe, that the parts of  
 matter having this stated capacity of access, &  
 Recess to & ffrom y<sup>e</sup> center, it is not changed by  
 any thing that can be done to them, unless  
 you Could work a coalition of severall un=  
 porous part's into one, & assigne that a New

A new shape, w<sup>ch</sup> must be agreed impossible to any thing less then the allmighty. but if you Conglomerate them together, you have Compound body's such as wee are acquainted with, and ffind pervious to subtile Matter, w<sup>ch</sup> play's throo & throo, & Communicates fforce to it in almost all places ffrom y<sup>e</sup> generall inclination of y<sup>e</sup> vortex to work it to Complaisance, Either by Moving it to or ffrom the Center, so that heat, Cold nor any other affection of body alters the Gravity of a body, w<sup>ch</sup> depends upon the immutable shape & Quantity of y<sup>e</sup> parts.

perpend<sup>105</sup>

Againe this Energy of y<sup>e</sup> vortex, is not to be Respected as arising in that particular place where y<sup>e</sup> Effect is but ffrom the whole Sphere of Rowling Matter, in w<sup>ch</sup>, according to the rule of Motion, that y<sup>e</sup> least body with any fforce Moves y<sup>e</sup> Greatest in Some degree Every body or part influenceth Every other in y<sup>e</sup> whole world more or less, w<sup>ch</sup> is a Consideration very unpopular, but in My opinion true, & without reasonable objection So that when a body fall's, it is not y<sup>e</sup> force arising in that region onely that causeth it, but y<sup>e</sup> whole Sphere. ffor the ffall of that body inlargeth y<sup>e</sup> Space outwards to y<sup>e</sup> outmost limits and force works w<sup>ch</sup> way Ever there is a yeilding to it.

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<sup>105</sup> Another small note to himself, presumably an alternative word.

Lastly this must work a body to descend in perpendicular lines, because that way it yeilds most to y<sup>e</sup> force, & makes Most room outwards And to demonstrate the probability of this operation of y<sup>e</sup> vortex, I will proposes a ffamiliar Example w<sup>ch</sup> ffits it to a hair, and Such usually lead soonest to setle most men's opinion's of truth in philosophy, tho y<sup>e</sup> Reason's are obscure. And this is of water, & a lighter body immerst. the whole water presseth downwards, but if you Respect y<sup>e</sup> particular parts you must needs beleev them moving latterally & every way; the body also moves downwards by its owne tendency, but there is a fforce in y<sup>e</sup> water w<sup>ch</sup> raiseth it againe. w<sup>ch</sup> force, tho round it, is prevalent underneath to strike it upwards, and cannot be say'd to come from any particular place of y<sup>e</sup> water, but from y<sup>e</sup> Whole conveyed by y<sup>e</sup> irregular part's, and imparted by Numerous strokes or impulses. so y<sup>e</sup> body riseth in perpendicular becaus that makes way fastest to y<sup>e</sup> water descending. Now w<sup>t</sup> is y<sup>e</sup> vortex but a Sphear of Matter crouding from y<sup>e</sup> Center, the Result of w<sup>ch</sup> in Gross, & visibly Must be the Repelling that w<sup>ch</sup> hath less force ~~from~~ /to\ y<sup>e</sup> Center w<sup>ch</sup> is y<sup>e</sup> very action of Gravity.



3. I am next to shew the Relation this hypothesis hath to ye Creation and Continuance of the sun & planets, to w<sup>ch</sup> it is so admirably Conformable, that to me the very Countenance of truth shines in it. ffor.

1. the Sun possesseth the center of our world, or the great vortex, and is probably Concluded to be a ffiery body, w<sup>ch</sup> Consists with our hypothesis. fire is the rapid agitation of terrene matter, to such a degree, that it works upon other like matter, to dilacerate it, & excite a Conformable Motion. and it is most likely that matter apt to burne, is such as is composed of the smallest, & most angular & pungent parts. ffor it hath a corroding & corrupting Effect, w<sup>ch</sup> Consist's not with Globous parts, and ye motion must be rapid w<sup>ch</sup> is not so Easily excited in larg body's and it is apt to tear & Rend w<sup>ch</sup> shew's ye part's are small so as to insinuate into the pores of other like body's, to break them up. and the part's of this sort, are such as the action of Recess, hath Crouded to the Center where they Compose that body of ffire w<sup>ch</sup> wee cal the Sun; & wee have reason from ye invention of ye excellent Des Cartes to beleev ye fixt Starr's to be of ye Same Nature.

Yet I doe not thinck it att all necessary that the sun should be such a pure & clear fire. as it seem's to us, who are at to great a distance to discerne irregularity's, but rather an heap of ignited Matter, much like our burning Mountaines in y<sup>e</sup> time of Eruption. But, as by y<sup>e</sup> peak of Darby, wee may judg of y<sup>e</sup> alps, so wee must suppose the impetuosity of that ffire generall, and vastly More then any thing wee know. the whole Globe of y<sup>e</sup> Sun being in that Condition perpetually Rending tearing flaming & smoaking. And the grosser, & less ardible stuff sometimes Getts together, &, swim's in ffire, y<sup>t</sup> to us is discernable by telescopes, & are called Maculae, And wast by degrees, till wholly absorpt, and as stuff least Combustible, when made to burne is most furious, so those Maculae when reduced't againe to fire, may be more strong then y<sup>e</sup> rest, & appear to us in those mark's y<sup>e</sup> astronomer's call faculae.<sup>106</sup> these thing's wee doe not assert otherwise then as fancy & conjecture, as thing's probable & agreeing with y<sup>e</sup> Cours of Nature; w<sup>ch</sup> wee may be the bolder in, becaus wee are in a feild without possible Experience, & Guess is the onely point, never to be received but in matters quasi indifferent to or hypothesis. & May be one way or other, without shaking principles

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<sup>106</sup> i.e., the bright spots on the sun's surface

2. Next wee have to doe with the planets, w<sup>ch</sup> we must distinguish Some having vortexes & some None, and doe admitt different considerations. and becaus the Earth & Moon Comprehend both, I shall intend them, unless I mention others.

The planet, its vortex, & Satellites being all carryed together in y<sup>e</sup> Great vortex of y<sup>e</sup> Sun, are to be lookt' upon as one body, with Regard to y<sup>e</sup> sun, as much as a single planet without vortex or satellite, as venus & Mercury May be. These planet's being huge congeries of Matter cemented together, have like all other body's ~~toget~~ a tendency in a strait line, and it is a very amazing thing that, whilst Nothing but the most pure Ether is about them, w<sup>ch</sup>, (setting aside or hypothesis) is indifferent to any Motion, they should be Restrained to a circle, unless you will admitt that this universall action of y<sup>e</sup> tang<sup>t</sup>-Recess operates upon them. So that if accident or power should fforce them beyond their circle, that should Reduce them, and if within their circle, set them back againe till they arrive to a station, wherein their Solidity is Equalibrated with y<sup>e</sup> Ether.

And this solution seem's to me most plausible  
 ffrom y<sup>e</sup> Consideration of w<sup>t</sup> hath bin said of the  
 degrees of Matter setling in y<sup>e</sup> vortex, the  
 small & weakest at y<sup>e</sup> center, so the  
 Stronger outwards, gradually & proportiona=  
 bly to the Selvedg of the sphere. if the pla=  
 netts were ffire, or such Matter as y<sup>e</sup> Sun is,  
 they would fall downe into it, or iff they  
 were such as Resides in y<sup>e</sup> utmost part's they  
 would ffly up thither, ffor y<sup>e</sup> Strongest would  
 p<sup>r</sup>vaile till it Comes to a Counterpois. but  
 it is plain that our planet, is of a mixt  
 Nature, not alltogether fire, tho there be a  
 great deal of it, nor alltogether incombus=  
 tible, but Crusted with Matter that will  
 without Much fforce become ffire. therefore  
 it ought to have a midle station in y<sup>e</sup>  
 Ether is of such capacity, as our planet  
 taking it alltogether hath. where it is Equi=  
 librated, & Rests Moving placidely with y<sup>e</sup>  
 Ether as wood swim's in water insensible  
 of y<sup>e</sup> force that Convey's it. Upon this Conside=  
 ration y<sup>e</sup> astrologer's are in y<sup>e</sup> right who al=  
 ledg quality's in y<sup>e</sup> planet's, as Mercury  
 hot & nimble, & venus in another degree  
 but Saturne plumbeous & cold, ffor their  
 Severall Qualificatio's have fixt them  
 in proper Sphears.

But it is Not y<sup>e</sup> distance of the sun, that Makes so Much difference, as wee may beleev there is in heat & Cold betwixt y<sup>e</sup> planet's, but the severall constitution's of them. ffor wee ffind that far from y<sup>e</sup> Earth & neerer y<sup>e</sup> sun there is less heat. and it is becaus the matter near y<sup>e</sup> Earth is susceptible of heat, more then that More Remote. & therefore presseth with More violence towards y<sup>e</sup> Center. being of y<sup>e</sup> weaker sort. but the solidity of it hinders neerer approach, y<sup>e</sup> place being ffilled.

1. As for those planets w<sup>ch</sup> have vortexes & Satellites No more is to be sayd, but the same Regards the whole have to y<sup>e</sup> sun, have the satellites, y<sup>e</sup> parts, to them: and the same discours is proper Mutati Mutaendis,<sup>107</sup> it is Not ffound that the secondary planets, or satellites have any vortexes, so that there is but one degree of subordination; & those satellites are deteined in due distance from their center, in y<sup>e</sup> Same Manner, as y<sup>e</sup> principle planet is from y<sup>e</sup> Sun. onely there is this difference, that As our Earth never keeps y<sup>e</sup> Same face to y<sup>e</sup> sun, but y<sup>e</sup> Moon keeps y<sup>e</sup> Same face allway's to the Earth, w<sup>ch</sup> the same reason still Governes. ffor it is likely one side of

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<sup>107</sup> i.e., 'that being changed which needs to be changed'

y<sup>e</sup> moon is heavier then y<sup>e</sup> other, & that must be neerest y<sup>e</sup> Center, nothing naturall is positively Regular.

2. As to the planets w<sup>ch</sup> have No vortexes it hath bin Made a great Quere how their part's are kept together, and that hath also bin weilded ag<sup>t</sup> this hypothesis, as a fatal objection to it. it is certain that if there were a vortex Either that would work upon y<sup>e</sup> planet & turne it, or in time y<sup>e</sup> planet would work upon that, & with y<sup>e</sup> ruggedness of its face stop it. & without a vortex this reason of Gravity Cannot take place. & y<sup>e</sup> circum ambient fluid will perpetually depredate y<sup>e</sup> Surface of y<sup>e</sup> planet till in time it will be wholly dissipated & wasted.

All y<sup>t</sup> I can Say to it, is that there May be other causes to keep the parts together; as. 1. the obdurateness of it. wee see Rock's remain ages unaltered, tho Exposed to Meteors & y<sup>e</sup> weight draws y<sup>e</sup> parts from it, neither of w<sup>ch</sup> can wee positively ascribe to the Moon. ffor that is of a cold constitution be caus ffarr from y<sup>e</sup> Earth, w<sup>ch</sup> is not so very hot it Self, & therefore not obnoxious to Corruption to separate its parts.

2. There May be somew<sup>t</sup> like magnetisme as stone's & mettall's here have, w<sup>ch</sup> are of a cold Nature; or somew<sup>t</sup> like y<sup>e</sup> humour of Jett, & Glass, w<sup>ch</sup> rubbed will attract, straws. or. 3. Supposing None of these it is probable that the Ether there is Not so Corroding in that Cold Region as it is here, where (if traveller's Say true) upon y<sup>e</sup> highest Mountaines, Ashes & Dust are never disturbed. and besides that caus that deteineth the whole planet in its station, deteines all its parts there, & w<sup>t</sup> should devide them? for ought wee know if part were separated, [~~it~~] it would not come to againe, but Move on in a parallel direction. there is somewhat like this in Saturne the ansae of w<sup>ch</sup> planet are body's devided from it. but w<sup>t</sup> or how, wee can scarcely be any assured. W<sup>ch</sup> of all these Reason's take place I cannot determine; it is Enough that this hypothesis is Not oppugned by y<sup>e</sup> subsistance of the unvorticall planet's, tho deprived of y<sup>e</sup> help of Gravity to keep their parts together, w<sup>ch</sup> May possibly be ffor many other reason's.

Comets are planets y<sup>t</sup> Never meet with a ballance so are lost, but those are y<sup>e</sup> Co'sideration of a particular Chapter.

To Conclude this head, it seem's that this hypothesis is so facile & intelligible, that wee must beleev that if the sun's vortex & the planets were all blended together in Caos & confusion, and ye vortication's it now hath inspired into it Must settle in ye very forme that it Now hath, and could not Emerg otherwise; and as I have Shewed, answere all the generall phenomena of ye World. w<sup>ch</sup> Makes me somew<sup>t</sup> admire, that when it was So happily hinted by des Cartes, ye World did not Greedily Embrace it, & possess it as an uncontrovertible systeme, Especially having E=ver laboured under perfect inscience, in the most sensible quality of body. and when it is necessary that such a potent cause, as the tangent Recess is, must have a Correspondent Effect somewhere, and wee must needs be sensible some way of it, w<sup>ch</sup> wee are not at all unless this way. therefore I leave it with this that untill I find some other Effect to answer that caus, or some other caus to answere that Effect, I shall Joyne these as Most Consonant and be pleased that I am discharged of the most uneasy curiosity, or, (if I may be so free), the paine of wisemen & pleasure of fools wonder.



4. I am satisfied that there are objection's and considerable ones to w<sup>t</sup> hath bin discourst w<sup>ch</sup> may be hard to answere, altho there is notwithstanding great reason to Continue the same opinion. ffor want of informa= tion of some fact, may help an objection. and in Matter's of this nature, I thinck argument's & objection's may be multi= plyed to infinite, as in all other sciences where wee have not positive principles or law's to governe y<sup>e</sup> Controversie. but yet I will Enumerate them, & subjoyne some answers, both as short as y<sup>e</sup> matter will ad= mitt.

j. obj. It hath bin say'd that the whole systeme of Des Cartes, of vortexes is chimericall. and that if there were such they Must spend their fforce in a Short time. or at least the Contiguous vortexes blend together because they are fluids pressing one & other w<sup>ch</sup> use to Mix, so y<sup>t</sup> y<sup>e</sup> univers Could not subsist in that Condition.

That the vortex of y<sup>e</sup> /sun\ Subsists, is No less then demonstration ffrom tha Motion of the planets in it. ffor its agree'd they are Solid Globes & circulate y<sup>e</sup> sun. Either they are Carryed thro y<sup>e</sup> Ether or are forc't thro. the latter cannot be true, becaus that force in So Small a body as a planet in so great as the Ether, would soon be spent without a pepetuall Renewall of w<sup>ch</sup> wee have not y<sup>e</sup> least intimation, & it can be no less then miracle. besides the Motion would not be facile as it is but impetuous & roaring ag<sup>t</sup> y<sup>e</sup> Resistance it Should meet with as a canon bullet ag<sup>t</sup> y<sup>e</sup> air, and brush all y<sup>e</sup> houses & inhabitants from y<sup>e</sup> Earth; and also y<sup>e</sup> heaviest part would proceed, & y<sup>e</sup> lighter ffollow, & Not turne so stedily as it doth.

Next it is certain this vortex doth not  
 Extend so farr as y<sup>e</sup> fixt starr's, because they  
 have no share of the Motion. whether the  
 confines be other vortexes, or different sort  
 of Ether, like oyle to water, so not apt to  
 Mix with this, is not an ~~materiall~~ abso=  
 lutly necessary knowledg to sustaine the opi=  
 nion of a vortex in o<sup>r</sup> world, for w<sup>ch</sup> wee  
 have a full demonstration. and none can  
 affirme it is impossible to subsist with an  
 omniscience, w<sup>ch</sup> I suppose ffew will p<sup>r</sup>tend  
 to. but to shew that, granting o<sup>r</sup> neighbour  
 Region's are vortexes to other star's, such  
 vortices may confine Each other, I will sub=  
 joyne My fancy. w<sup>ch</sup> is that the Matter be=  
 tween the two vortices, is perfectly Stagnant  
 Even where they press most; in y<sup>e</sup> utmost Con=  
 vexity's as well as in y<sup>e</sup> spondrells. ffor wee  
 ffind the celestially Matter Move slower as it  
 is ffar distant ffrom y<sup>e</sup> center, ffor Mercury  
 dispatcheth his circle in few weeks, & saturn  
 not under 30. year's. therefore y<sup>e</sup> motion being  
 Slower as it is farther distant, comes to be  
 litle or Nothing in y<sup>e</sup> Extremity, the ra=  
 ther because it meets with different motions  
 w<sup>ch</sup> obstruct it. & that works on Each side  
 so that the Matter conformes to neither  
 but as to them Rests and on Each side the  
 fforce begin's gradually, & y<sup>e</sup> Swiftnes in=  
 creaseth to y<sup>e</sup> very center.

Then it is no More a Wonder that the force should Continue in y<sup>e</sup> vortex, ffor it is so much Matter inclosed like water in a vessel, w<sup>ch</sup> will continue to Move till y<sup>e</sup> friction of y<sup>e</sup> Sides stop it and w<sup>t</sup> a mighty friction and /for\ w<sup>t</sup> a mighty time must it be, w<sup>ch</sup> stops such a mighty mass of matter as this is, to W<sup>ch</sup> Wee and all wee know is so inconsiderable, y<sup>t</sup> it Cannot be say'd to hold any proportion. and y<sup>e</sup> Number of years y<sup>t</sup> wee beleev y<sup>e</sup> world hath Continued is a wretched duration, in a comparison to the vastness of the body; Every child's top performs more turnes then y<sup>e</sup> world hath done, before it falls. then w<sup>t</sup> a wretched span is y<sup>e</sup> life of a man, who thinck's himself so considerable that all changes must happen in his time & in his notice, or thing's are immutable. The w<sup>t</sup> should stop the vortex? you will say the ambient stagnating Ether, by y<sup>e</sup> impulses of y<sup>e</sup> part's upon it. I say that Returnes as Many, and ffrom the other side, it is possible fforce may be transmitted by impulses of y<sup>e</sup> Medium to o<sup>r</sup> vortex & give life to it; however allowing that a stronger vortex gaines upon us (for w<sup>t</sup> fforce is lost upon y<sup>e</sup> Stagnant matter is found againe in y<sup>e</sup> conformity Made to y<sup>e</sup> force spent) it is by accident, and possibly wee may Regaine it, & more; nay D. Cartes fancy is most Reasonable thatt one vortex

And its starr & planet's become Comets  
 but w<sup>e</sup> age's or Miriads of ages must  
 be allowed ffor such a Mutation, and how=  
 many miriads of odds is it, it Should never  
 happen to us; seeing wee find that most  
 thing's in y<sup>e</sup> world bring themselves to a  
 ballance, before theres any Rest. and why  
 Should not y<sup>e</sup> heaven's as well as the rest  
 when subject to y<sup>e</sup> Same laws. thus much  
 I thought ffit to say in vindication of o<sup>r</sup>  
 most Excellent hypothesis.

2. obj. It may be say'd that y<sup>e</sup> Sun Can=  
 not be fire, becaus that Expires  
 unless continually ffedd, with Com=  
 bustible matter, w<sup>ch</sup> it doth not  
 appear y<sup>e</sup> Sun is supply'd with.

The matter of y<sup>e</sup> Sun is a perpetuall pabu=  
 lum to it self, ffor that a thing hath once  
 burnt is No impedim't to its burning a=  
 gaine. and all y<sup>e</sup> ffrothing Smoak & flame  
 w<sup>ch</sup> thro's up matter out of y<sup>e</sup> Sun, doth not  
 wast its substances, because the same matter  
 Returnes againe, for y<sup>e</sup> same reason w<sup>ch</sup>  
 brought it there at first, whereas culinary  
 fire disperses the materiall so that it Could  
 never be brought together againe; but sup=  
 posing it Colligible, it would maintaine a  
 perpetuall fire. and such part as sticks by  
 y<sup>e</sup> way in soot makes as fierce a fire as the  
 best fuell.

3. obj. It hath bin say'd that if lightness were y<sup>e</sup> positive & Not Gravity, wee might Shew somew<sup>t</sup> actually light w<sup>ch</sup> wee doe not but all thing's are actually heavy, & no=thing ascends but as it is p<sup>r</sup>ponderated by other body's, w<sup>ch</sup> are more heavy.

The answer to this is very Easy; ffor how can wee come by any thing actually light, when by y<sup>e</sup> very Construction of o<sup>r</sup> hypothesis, all such matter is Most Remote from y<sup>e</sup> center? and how can wee Meet with any thing, but w<sup>t</sup> is actually heavy who live neer y<sup>e</sup> center where such Matter is Coll=ected? I make no great doubdt but if a lump of y<sup>e</sup> Moon's substance were brought downe to us wee should be surpris'd with its lightness; there=fore this objection doth not touch the point, that lightness is y<sup>e</sup> positive, & Gravity y<sup>e</sup> Consequent.

4. obj. That a lump of Gold being Conglobated in one body, & hath such force to persevere in Motion thro the air, when put in mo=tion should have more force to Move in y<sup>e</sup> tangent then air, & be Consequently lighter.

This objection is sensuall, ffor in an arch of our observation there is No difference between the tan=gent & y<sup>e</sup> arch, but both are quasi y<sup>e</sup> Same strait line, and wee are not to Expect a separation. unless you could suppose all impediment of weight Removed, & y<sup>e</sup> lump of Gold left at larg

to take its Cours, it would certainly, as y<sup>e</sup> law's of Motion Enforce, leav y<sup>e</sup> Earth and move in a tangent; but as it is a body Composed of y<sup>e</sup> weakest part's, (or at least, more compact) then other's, w<sup>ch</sup> were brought downe by y<sup>e</sup> generall protrusion of y<sup>e</sup> vortex, /&\ loos not their nature by being but together, as was before observed, therefore /y<sup>e</sup> lump must\ Continue heavy. and that force being

q<sup>a</sup>

~~continually upon it must~~ master y<sup>e</sup> vis im=  
pressa w<sup>ch</sup> tends in a tangent; ffor that would not separate it an inch in ten miles progression, therefore weak by y<sup>e</sup> law's of Mechanicall Motion, and weaker in y<sup>e</sup> proportion of an inch to ten miles, and so y<sup>e</sup> weight keepeth it close to y<sup>e</sup> surface of y<sup>e</sup> Earth.<sup>108</sup>

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<sup>108</sup> The shaded section is scribbled out.

5. obj. Dyamonds are not heavyer then wa=  
 ter, and are ye most Compact and ob=  
 durate body that is, being most diffi=  
 cult to break, or wear away, then  
 Gold is soft, and likewise lead, w<sup>ch</sup> out=  
 wey diamonds, as. 1. to. 19. therefore in  
 probability should be heavier then Gold,

To Dogmatise about ye Minute parts of Com=  
 pound body's, were to incurr a fault I have  
 always disapprov'd in other's. therefore I Can=  
 not affirme one way or other in y<sup>t</sup> Matter,  
 but being ledd to it, will tell my fancy only.  
 w<sup>ch</sup> is that the Matter about ye surface of the  
 Earth, whether Earth stones water mettall  
 or ought Els are much of an intrinsick weight  
 as I Suppose it to be in other part's of ye vor=  
 tex thro w<sup>ch</sup> from center to [circumferencee?]  
 doth the force of ye matter Correspond the dis=  
 tance, and onely so Could it Come to a ballance  
 in ye fluid Ether, but neer ye centre it Grew so=  
 lid so that ye matter is heapt & stopt ffrom ma=  
 king a ballance, as in ye fluid; but ye Surface  
 would goe yet neerer if way were Made.  
 But yet the heavyest part's ffell first, & there  
 is No Reason to Conclude, but generously Spea=  
 king ye heavyest Matter is Nearest ye Center  
 but however differences May intervene, and  
 as I have often say'd, Nothing Naturall is  
 Regularly disposed, the variation ffrom this ine=  
 Quallity, is Not so considerably, & doth Not ap=



Appear to us So Grossly, as the difference of substance. therefore for the Most part weight is a practicall test of Quantity. but then Some species of body's seem to have more intrinsick weight then other's, as Gold then silver or Iron. without any discernable difference in y<sup>e</sup> Quantity. to that I say, that there may be such porosity's in one that shall substract half y<sup>e</sup> substance, compared with y<sup>e</sup> other. And since y<sup>e</sup> part's are So inscrutable who Can say that a Cube of Gold hath not. 20. times y<sup>e</sup> terrene substance that a like Cubick diamond hath. and I can add this as a conspicuous Evidence that Gold is More Compact then Dyamond, becaus this is pervious to light, with the greatest facility of any, w<sup>ch</sup> infallibly speak's considerable porosities, whereas the other doth not transmit a Ray tho Reduc't to y<sup>e</sup> thinness of y<sup>e</sup> smallest imaginable hair. So that objection's raised ffrom inscrutable principles, are in my opinion answered by shewing it to be possible y<sup>e</sup> fact May be otherwise, & consistent with o<sup>r</sup> designe.

6. obj. By y<sup>e</sup> principles lay'd downe, ffire ought to be heavyest, but wee find it allwais to be light & aspiring.

It is true y<sup>t</sup> y<sup>e</sup> Matter apt to burne, is of the heavyest sort, but Matter burning, admitts a different Consideration. Whether Iron heated weigh's More or less then Cold, & y<sup>e</sup> like I Referr to Experiment, w<sup>ch</sup> I have Not Made. but I suppose the p<sup>r</sup>sent Contemplation is of flame w<sup>ch</sup> I confess appear's to Rise more then any thing Els. but y<sup>e</sup> Consequence is a ffallacy. ffor the Same space of a rarified body, Conteins less matter then in a Dens. and therefore is lighter ffor y<sup>e</sup> adventitious Ether is Not Considered in y<sup>e</sup> weight, Every thing being pervious to it, so that it goeth, & Comes upon Every accident leading it. the air is a fluid uniformly mixt therefore ballanc't with it self, but if a space happen to be more rarified, it becomes lighter, becaus it contein's less gravitating substance, & will rise when opposed with y<sup>e</sup> like Measure of Dens. as Boyles Experiments shew.<sup>109</sup> Now flame is Combustible Matter turned into air, with y<sup>e</sup> Greatest refraction, but devided from it by y<sup>e</sup> agitation of it, w<sup>ch</sup> is to such a degree, as to beat off y<sup>e</sup> air round it, so that within y<sup>e</sup> Compass of y<sup>e</sup> flame, there is nothing but ignited Matter & Ether. ffrom hence it appears that flame

q<sup>a</sup>.

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<sup>109</sup> Robert Boyle (1627-91) was not the discoverer of the expansion of gases, but his publication of the relationship between pressure, density (and temperature) in gases in the early 1660s (not all of the ideas and formulations being his own) was a significant event in the history of physics, and physics in Britain. Prettuy everything RN has to say about 'air' (see below, ff 309-21) comes from the work of Boyle and his associates.

Must be lighter then air. But ffurther the stream of this ignited matter, flowing from y<sup>e</sup> pabulum of y<sup>e</sup> flame, makes a stream of air, w<sup>ch</sup> licks y<sup>e</sup> flame, & tosseth it so that it seem's to aspire with More impatience the in truth it doth. but smoke, w<sup>ch</sup> is y<sup>e</sup> same substance as fflame, onely having y<sup>e</sup> air Mixt with it. riseth or ffalls according as y<sup>e</sup> nature of y<sup>e</sup> Stuff is. but for the most part it ballanceth in y<sup>e</sup> air, being of y<sup>e</sup> Same Nature with it. & y<sup>e</sup> Minuteness of y<sup>e</sup> parts takes off so much of the force, compared with y<sup>e</sup> Superficiall Resistance, that Granting it Somewhat heavyer, y<sup>e</sup> force is not Effective. But about this Matter I have designed a particular Chapter.

7. obj. The Greatest objection to this Hypothesis w<sup>ch</sup> occur's to me, tho never made by any body to my knowledg, is that the tendency of Gravitating body's must be to y<sup>e</sup> axis, & Not y<sup>e</sup> center of y<sup>e</sup> vortex. ffor in that line is y<sup>e</sup> Center of Every parallel circle of y<sup>e</sup> Motion, ffrom w<sup>ch</sup> y<sup>e</sup> Recess is Supposed to be.

This is answered before in y<sup>e</sup> Cours of deducing the systeme, but I must Repeat somew<sup>t</sup> of it to [Reffell?] this objection. it is one of y<sup>e</sup> Rules of Mechanicks, that if y<sup>e</sup> weaker body hath any line free to move in, w<sup>ch</sup> will make any way ffor the stronger to pass on in its Cours or towards it, the weaker shall Move in that line, tho varying from the tendency of the stroke. upon w<sup>ch</sup> principle depends all the reason of windmill, ship, & other wedg work motion's. Now if the polar Matter ~~Maketh way ffor~~ coming to the Center Maketh way ffor the Equinoctiall, & y<sup>e</sup> paralell matter to Recede from it, it shall move accordingly. & it is very plaine it doth so. and if it be say'd that then under y<sup>e</sup> pole, things will wey less then in y<sup>e</sup> Equinoctiall, I answere that the Earth in comparison of the whole vortex, whose intire force work's upon Every part, is so small & inconsiderable, y<sup>t</sup> y<sup>e</sup> difference (if any be) is not perceptible by us.

But it may be considered likewise. that the action of y<sup>e</sup> parts, w<sup>ch</sup> tend to this Effect, of Gravity, is infinitely various, & works laterally as well as directly, & all manner of way's and consequently y<sup>e</sup> force is ledd, by y<sup>e</sup> irregular Matter to y<sup>e</sup> poles, as well as Elsewhere A Drop of water is round, when suspended in y<sup>e</sup> air, w<sup>ch</sup> is y<sup>e</sup> access of all y<sup>e</sup> part's towards y<sup>e</sup> center. because it being prest on all sides, yeilds to y<sup>e</sup> force by that figure.

5. The next buisness is to Represent w<sup>t</sup> hypothes I have met with, for y<sup>e</sup> illustration of this Misterious phenomenon, wherein I have not Much to doe, becaus few have medled with it in Earnest, but lett it pass as an intrinsick Quality, making that a postulatam<sup>110</sup> in order to Mechanicall propositions, in w<sup>ch</sup> y<sup>e</sup> cause is Not Materiall, y<sup>e</sup> Effect being knowne.

1. First, Some have thought that body's approach y<sup>e</sup> Earth, by a sort of Magnetisme w<sup>ch</sup> y<sup>e</sup> centrall part's of y<sup>e</sup> Earth hath; like as y<sup>e</sup> loadstone hath to attract Iron.

This Resemblance is the onely argument ffor y<sup>e</sup> opinion, and if it held thro, might carry Some probability, but instead of that it varyes so much, y<sup>t</sup> y<sup>e</sup> likeness hold's in Nothing. ffor. 1. y<sup>e</sup> Magnet hath a polarity w<sup>ch</sup> doth as well Repell as draw, according as body's happen to be p<sup>r</sup>pared. but y<sup>e</sup> Earth draw's allike in all places, & att all times; 2. the Magnett affect's y<sup>e</sup> body it works upon with y<sup>e</sup> like vertue, w<sup>ch</sup> is not found in terrene body's. 3. y<sup>e</sup> Magnett draws by y<sup>e</sup> poles cheifly & with a giration & humour, as is seen by file dust thrown upon it, & about it. but y<sup>e</sup> tendency to y<sup>e</sup> Earth, is stedy & allway's in the perpendicular.

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<sup>110</sup> i.e., 'postulate'

At best it is but the assigning an unknown cause, which still leaves us in the dark and doth in no sort answer the Economy of the sun & planets, as Des Cartes way doth.

2. Others with More pertinacity have held that the action of all the Celestiall fluid, operates upon body's Residing in it, by perpetual Strokes such as the agitation of Every fluid produceth. And that this force comes in differently from all parts of the universe Except from that side which is towards the Earth, because that Not-so-easily-pervious body shelters that side from the Great part of the force, & then the other side prevails, & causeth the body to touch.

And this is supported by pretending that wood swimming in Calme waters, will approach & Joyne, Ships draw (as mariners Call it) & flame, smoke, & the like will wend towards adjacent body's & lick them. to which Instances I shall say Somewhat, but first Endeavour to dissolve the very System, which is mistaken in the very Construction of it.

For the striking of those parts, is such, that if the sides of the body gave way, the parts striking it would Enter. Else it Could have no force to

Move that body. then such fforce must be y<sup>e</sup>  
 same Wee call pressure; like that of a body im=  
 mers't in water, or atmosphere, and Nothing  
 is More knowne then, that such pressure, from  
 w<sup>t</sup> Ever region it Cometh, p<sup>r</sup>e forceth all parts  
 of y<sup>e</sup> body alike, unless the parts most Remote  
 from y<sup>e</sup> Region of y<sup>e</sup> force have y<sup>e</sup> Greatest Share.  
 ffor the irregularity of y<sup>e</sup> parts is such, that by  
 y<sup>e</sup> rules of motion, & y<sup>e</sup> direction of it, the force  
 of Every stroke must be conveyed Every way &  
 be dispers't thro y<sup>e</sup> whole fluid. w<sup>ch</sup> is Sensible  
 to a man under water, who feels y<sup>e</sup> weight  
 No more upon his back then his belly, tho  
 the force seem's to Come onely upon y<sup>e</sup> former.  
 the like is to be say'd of y<sup>e</sup> action of y<sup>e</sup> Ether,  
 if it have any force, it Must press all parts  
 of y<sup>e</sup> body Residing in it; and Granting y<sup>t</sup>  
 if y<sup>e</sup> Earth were out of the way. we should  
 have here more of that force, then wee have  
 whilst y<sup>e</sup> Earth is here, w<sup>ch</sup> is more then wee  
 need Grant, yet y<sup>e</sup> case is y<sup>e</sup> same. because  
 More, or less, when it bears indifferently upon  
 all y<sup>e</sup> Sides, makes y<sup>e</sup> Same ballance, &  
 carrieth no inequality to determine y<sup>e</sup> body  
 to Motion any way; w<sup>ch</sup> consideration's are  
 to be found in my discours of fluid Motion's  
 & cleary refute the proposition of this Systeme.



But as to y<sup>e</sup> matters of fact, I must State them  
& the see how farr I am to admitt. & w<sup>t</sup> to deny.

1. it is say'd that sticks, chipps, & blocks, swim=  
ming in water, shall come together. & not part  
again; & that they will gather about boats  
& y<sup>e</sup> Seamen say, that swimming they perceiv y<sup>e</sup>  
ship helps them in their Cours towards it, w<sup>ch</sup>  
they Call drawing, all w<sup>ch</sup> is imputed to y<sup>e</sup>  
caus already run downe.

That wood will fall out to be neer together  
in water, is frequent. but that, supposing a  
perfect calme, & still water, there is any stir=  
ring principle in y<sup>e</sup> water to dispose them to  
approach, I must deny, ffor I know no Experi=  
ment of it. but the reason of w<sup>t</sup> wee find is  
ffrom y<sup>e</sup> stirring of y<sup>e</sup> surface of y<sup>e</sup> water by y<sup>e</sup>  
aire & winds, w<sup>ch</sup> is seldome wanting in Some  
degree. and those worke less upon a great bo=  
dy then small, so that if y<sup>e</sup> Sticks & Straws are  
to windward, no wonder that they are driven  
upon y<sup>e</sup> greater. if they are on y<sup>e</sup> other side  
there is a shelter from y<sup>e</sup> wind, and an Eddy  
w<sup>ch</sup> leads them in. And whence once together  
they Cannot so Easily part; ffor they Guard y<sup>e</sup>  
surface of y<sup>e</sup> water, y<sup>t</sup> y<sup>e</sup> air work's not upon it  
so much as without, and if those body's are  
moved they carry y<sup>e</sup> upper water, all together  
as one body. W<sup>ch</sup> is plaine to be seen when

a Curling air Comes upon y<sup>e</sup> watry surface, y<sup>e</sup> places, where chips, or weeds are, there shall be no Curling att all. and the same thing take place with y<sup>e</sup> watry drops, wee call Clouds, w<sup>ch</sup> carry y<sup>e</sup> air along with them, as one intire mass, & therefore keep together; without any principle of access or cohesion, other then w<sup>t</sup> is described.

2. As ffor smoke & flame, &c. there is a stream attends them, w<sup>ch</sup> is checked by placing a rugged body neer, on one side. whilst y<sup>e</sup> other hath no such interruption. w<sup>ch</sup> must needs crook the matter that way. So when a Ship rides, w<sup>ch</sup> is for y<sup>e</sup> most part in a tides way, if any thing be brought by y<sup>e</sup> Stream neer the Ship, laying hold of y<sup>e</sup> water interupts it, and slaken's y<sup>e</sup> motion w<sup>ch</sup> may make y<sup>e</sup> outward water bear such body neerer y<sup>e</sup> Ship. and give occasion to say y<sup>e</sup> Ship draw's. and in this also, w<sup>t</sup> I sayd before is Materiall, ffor a man swiming to windward hath y<sup>e</sup> wind to help him towards y<sup>e</sup> ship, if to lee-ward, he hath y<sup>e</sup> shelter of y<sup>e</sup> Ship from the wind.

So that upon the whole, I conclude that none of these causes can be the cause, that body's descend with such violence towards y<sup>e</sup> Earth as wee find they doe, by y<sup>e</sup> force of Gravitation

6. Lastly I have onely to shew Some particular proposition's & experiments Relating to Gravity, w<sup>ch</sup> I thinck worthy of observation & Remembrance.

1. prop. That Gravity is a determinate force in Every individual body, and operates according to y<sup>e</sup> Generall rules of Motion.

And thus y<sup>e</sup> Mechanicks use it. ffor if obstacles be removed, the heavy body descends, & y<sup>e</sup> very inception of that Motion, is with a certain degree of velocity, w<sup>ch</sup> is y<sup>e</sup> measure of force in y<sup>e</sup> body, so that if you Subtract from y<sup>e</sup> Quantity you lessen y<sup>e</sup> force of it and adding you increas it. and this is the same thing as if that body moved with y<sup>t</sup> velocity upon y<sup>e</sup> obstacle. thereupon all experiments of weight, & the Comparison of it are Experiments of Motion in generall.

2. prop. That Gravity /at larg\ is a Stated or limited force, and a body may acquire a Swiftnes y<sup>t</sup> shall not increas by ffalling.

The proportion in w<sup>ch</sup> y<sup>e</sup> motion of descending body's accelerates, hath bin exquisitely sought and I thinck, ffrom y<sup>e</sup> nicest observation's, hath bin judg'd y<sup>e</sup> duplicate; but not being capable of demonstration, becaus y<sup>e</sup> figure & mea= of y<sup>e</sup> body, y<sup>e</sup> state of y<sup>e</sup> air, & y<sup>e</sup> utmost force of Gravity, are postulata w<sup>ch</sup> wee cannot grant and it being not materiall to o<sup>r</sup> Systeme whether this or any other be the true proportion I shall not medle with it. But y<sup>e</sup> p<sup>r</sup>sent pro= position I thinck tenable. becaus the force pro= ceeds from y<sup>e</sup> vortex, w<sup>ch</sup> wee see is limited by y<sup>e</sup> fixt star's, w<sup>ch</sup> never chang their places. and that force is imparted by y<sup>e</sup> strokes of minute parts upon y<sup>e</sup> body, w<sup>ch</sup> are with a determinate swiftnes; and when y<sup>e</sup> Motion of falling is as swift as, y<sup>t</sup> of y<sup>e</sup> parts w<sup>ch</sup> drive it, there can be no farther increas. the impedim<sup>t</sup> of y<sup>e</sup> Medium doth Resist somew<sup>t</sup>, Makes a ballance Sooner & also y<sup>e</sup> figure of y<sup>e</sup> body w<sup>ch</sup> Makes y<sup>t</sup> more or less. No body hath y<sup>e</sup> swiftest Motion at first, but by degrees; for it is made by small parts Striking greater, vis<sup>t</sup>, y<sup>e</sup> heavy body, & y<sup>t</sup> raiseth a slow motion.

<diagram>  
(in ink over pencil)

3. prop. All thing's (ceteris paribus) have less force to descend ffrom an high, then ffrom a low station.

Here I abstract the Consideration of matter differently Qualified disposed gradually ffrom y<sup>e</sup> Center, y<sup>e</sup> More forcible being always towards y<sup>e</sup> circumference, w<sup>ch</sup> must accelerate y<sup>e</sup> Returne of a body raised into it, y<sup>e</sup> ballance Requiring it, but Suppose y<sup>e</sup> force of descent positive in y<sup>e</sup> body under Question; And I say that that force shall have less Efficacy in an hight then in a low station. w<sup>ch</sup> I thus demonstrate.

E. F. - the Earth

A. C. = B. D. 2. pendulum's. at different heights. viz<sup>t</sup>. A. & B. y<sup>e</sup> fulcrum's.

A. E. the perpend<sup>r</sup>. of y<sup>e</sup> fulcrum.

C. E. the perpendicular of y<sup>e</sup> station. C.

D. E. the like of y<sup>e</sup> station. D.

Ang. A. C. E.  $\geq$ .<sup>111</sup> B. D. E.

The force y<sup>t</sup> draws. C. towards B. is by y<sup>e</sup> line

C. E. y<sup>e</sup> perpend. the like of D. by D. E.

Now the latter drawing by y<sup>e</sup> greater ang.

hath Mechanically the most force.

It ffollow's that y<sup>e</sup> Same pendulum in B.

shall vibrate faster then in A.

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<sup>111</sup> RN's uses a symbol more like a closed-off equals sign.

But whether this proves y<sup>e</sup> proposition is a Question, ffor it will be sayd y<sup>t</sup> w<sup>t</sup> force y<sup>e</sup> perpendicular is Rot<sup>d</sup> off y<sup>e</sup> fulcrum holds. and w<sup>t</sup> force y<sup>e</sup> fulcrum is Eased of, work's in y<sup>e</sup> perpendicular, so that still y<sup>e</sup> body hath its positive weight, Either operating or supported.

This I cannot deny. but observe. let the pendulum be in y<sup>e</sup> perpend<sup>r</sup>. of y<sup>e</sup> fulcrum. A. B. y<sup>e</sup> place of Rest. a less force will Remove it in B. then. in. G. towards. C. & D. then imagine y<sup>e</sup> fulcrum changed. and instead of a suspension by a string at a point above y<sup>e</sup> body, let it be by a point underneath it, as if it were a globe Resting upon a plane. Doth it not follow that, if y<sup>e</sup> pendulum be moved out of is perpendicular Repose with less fforce, the Globe may be Rolled upon y<sup>e</sup> plane with less force also? Then againe. if y<sup>e</sup> Globe may be Rolled with less force, doth it not follow that is presseth y<sup>e</sup> plane less? ffor nothing can make a difference in y<sup>e</sup> facility of Moving y<sup>e</sup> Same Globe upon y<sup>e</sup> Same plane, but that w<sup>ch</sup> makes it press more or less. other thing's are all alike. then if y<sup>e</sup> Globe presseth less, is it not lighter, and lyable to be raised, by a less force? I cannot answe're any of these Matter's, w<sup>ch</sup> makes y<sup>e</sup> proposition Enigmaticall, but I will Endeavour to look farther into it ffor clearing it

Wee must look into y<sup>e</sup> Caus to find an Edipus to solve this Mistery. to w<sup>ch</sup> end I construct this figure.

<diagram>  
 (Ink over pencil, plus some pencil. Here, as in the diagram on the next page, a compass and rule have been used)

C. The center.  
 A. & B. y<sup>e</sup>. 2. Station's of y<sup>e</sup> Globe.  
 A. D.) y<sup>e</sup> tangent of (A) & Equall. &  
 B. F.) (B)  
 are the planes of those. 2. Stations.  
 F. G. <. E. H. y<sup>e</sup>. 2. tangent Recesses of those 2. planes.

Now I say that y<sup>e</sup> Glob in Moving upon y<sup>e</sup> plane A. D. Recedes from y<sup>e</sup> center but y<sup>e</sup> Space E. D. but in Moving upon y<sup>e</sup> plane. B. F. it Receds Much more vist. G. F. then in Con= sequence, a less force will raise y<sup>e</sup> body. E. D. then G. F. or Move it, upon y<sup>e</sup> plaine.

This Reson Resembles that of Mechanicall powers, as

E. D. ) the recess )	(the weight
G. F. ) )	(
	(
A. D. ) the planes. ) Corresponds to.	(the fulcrum
B. F. ) )	( & also -
	(
y <sup>e</sup> power motive )	(the force.

Here y<sup>e</sup> Weight Moves less space the y<sup>e</sup> force in y<sup>e</sup> Same time in A. then in B. therefore y<sup>e</sup> force hath y<sup>e</sup> advantage.

flying of  
birds.<sup>112</sup>

This further demonstrates the facility of Moving  
body's laterally in a high station. but it may be  
sayd yet that raising in a perpendicular is  
same. as to that consider this demonstration.

<diagram>

(Ink over pencil,  
plus some pencil.)

- C. the Center.
- A. the body at Remote distance.
- D. E. the orb, of the body in y<sup>t</sup> Station.
- B. the body at Neerer Distance.
- F. G. the orb. of that Distance.

When a body is moved out of one orb, into a[n?] higher, there is a certein force y<sup>t</sup> Resists its Entrane and if a less body be moved, that Resistance is less. then if y<sup>e</sup> body in F. G. hath a certein resistance against its Rising, in D. E. it Shall have less, becaus that is a greater orb, & then y<sup>e</sup> body is to be Considerred as so Much less, & therefore hath less Resistance.

W<sup>ch</sup> Contemplation Extends to all degrees of rising, Even in water within our observation. if you suppose the rising & falling to be by Radiuses & Not by parrallells perpendicular. but the portion is so small in our orb, that it hath no regard nor is practically usefull, so y<sup>t</sup> y<sup>e</sup> pressure is Reputed to be by parrallells, & the onely height make's a difference.

The orb K. l. bears all y<sup>e</sup> impending force, and equall part's bears equall parts of y<sup>e</sup> force. so that K. l. bears all, within y<sup>e</sup> radiuses. K. D. & E. l. but rais K. l. to. M. N. & besides y<sup>e</sup> height it bears less as it is y<sup>e</sup>-p a less portion of y<sup>e</sup> orb.

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<sup>112</sup> An authorial note to himself.



I must Still agree this to be a double propositi= on. 1. that weights (ceteris paribus) have less force in an high station. 2. that pendulum's will (Respecting that diminution) vibrate slower!

4. prop -

It is beleaved that low in y<sup>e</sup> Earth weight hath less force the it hath higher up on y<sup>e</sup> Sur= face, and Mr Boyle hath publish't an experim't made in a deep Mine. by waying a body lett down by a long string, & the weighing y<sup>e</sup> Same body string & all, the difference whereof was considerable. As for y<sup>e</sup> Experiment I might Quarrel with it; becaus the friction of y<sup>e</sup> String with y<sup>e</sup> air, besides other accidents might pro= duce as great a variation. but y<sup>e</sup> proposition may be allowed true, becaus the matter is hea= vyer neer y<sup>e</sup> center, and a body upon y<sup>e</sup> Sur= face is in a lighter Medium then, low in y<sup>e</sup> Earth.

I Reserved the Consideration of the Sun, & other Celestiall Compounds, as also y<sup>e</sup> Constitution of y<sup>e</sup> Substances of y<sup>e</sup> planets, as may be Called terrestriall, to this place because the Subject of fire is mainely Coincident w<sup>th</sup> them. And In y<sup>e</sup> first place ffor knowing the Nature of fire, wee Must Rehears Some of the cheif phainomena of it, And those are what Every one may. In his owne chimney Corner observe, Referring the subtiler observation's to the chimists, It being My opinion In this, and most phisicall subjects, /that\ comon and dayly occurrences, for y<sup>e</sup> Most part are as Instructive, as nicer Experiments.

1. fire is certainly a violent agitation of the combustible matter according to its Minute parts; ffor the Effect by a speedy maceration of y<sup>e</sup> whole /mass\ Into parts & dissipating them severall way's, shew it; such dispatch /is\ not to be had by any other mean's whatsoever.

2. There are Notorious degrees as well as various Effects of fire, ffor some matter is Easily Inflammable and soon dissipated, other's not Easily wrought upon and are litle, or Nothing wasted. the former are the comon dryed vegetables, y<sup>e</sup> other /are Earth & fossiles, & out of them\ mettalls, and particularly Gold, w<sup>ch</sup> they say, wast's Not ~~in fire, that~~ /or rather.\ Not Sensibly /In fire|. Most Combustibles, w<sup>ch</sup> are /of\ the first sort, have these degrees, smoak, exhalation, & ashes. the Smoak is the Effect of rarefaction, w<sup>ch</sup> is caused by moderate heat, that Converts some part's Into air, that is Separates, them

-perates them in parts So Small, as In the air loos the force of their weight, and so they assimilate with, and I thinck, becomes Comon air. but this is Gradually for at first while y<sup>e</sup> part's are mutually neer & warm, a flame applyed shall light y<sup>e</sup> Smoak, & turne it Into flame; and by that /it\ is immediatly dispersed In y<sup>e</sup> air, Not shew=

ing it self but by y<sup>e</sup> light, Els vanisheth. The flame is y<sup>e</sup> same as smoak, onely set on fire, while y<sup>e</sup> other is but heated, y<sup>e</sup> farther distraction of them will be Considered anon. The next ~~action~~ process is Exhalation, w<sup>ch</sup> is after all the smaok & flame spent, then there is a Glowing as they call it, or a warm Exhalation or breathing out of y<sup>e</sup> matter Into y<sup>e</sup> air, Invisibly Except onely in y<sup>e</sup> Symptome

the glowing of y<sup>e</sup> coal. when that is spent the Remain= der is a matter wholly Inept for Exhalation, & falls in powder called Ashes. This is the Condition of vegetables whose combustion is comonly ascribed to sulfur; w<sup>ch</sup> is a substance, when separated from other materiall & in a body by it self; is the Most Inflammable of any.

Another sort of materiall Not Combustible without applycation of mighty force of fire, and Not Exhalable by any. Such are fossiles, as Earth, Stones, Glass, & Ashes

Thes may be Converted to Glass, but Will neither flame Not Exhale; and the chimists say, vitrification is the last effort of fire, so that all body's whatsoever tho Inept as to fire, may be made fluid, If force Enough be applyed; w<sup>ch</sup> proves that fluidity is but an agitation of the minute parts, Either moderate as liquours, or furious as Melted Mettals & Glass.

liquors are also Combustible, as oyle & spirits, w<sup>ch</sup> are but Extracts, or Collections apart, of a Materiall dispersed in vegetables, & Intermixed with other varieties, w<sup>ch</sup> to separate is y<sup>e</sup> Work of fire.

4. Rarefactions by fire are also done in all degrees, & Manners, ffor some body's rarefye slowly, as vegetables, and burne at y<sup>e</sup> Same time, others may burn but Not rarefye at all, as Mettalls & fossiles. and Some will Not burne but heat & rarefye; And Sometimes the rarefaction is so Sudden and violent, that it takes a new Name & is called Explosion, w<sup>ch</sup> is a phenomena So full of wonder, It hath a place by it Self.

It were an Endless as well as trifling buissness to go= over all these, and other phenomena of fire, and guess at y<sup>e</sup> formes, magnitudes, figures & dispositions, of the materialls, w<sup>ch</sup> are thus variously actuated, and produce them, when after all, It must be the proper Imagination of each one, w<sup>ch</sup> Must Represent it, and all wee can say that way will be litle or No assistance, since the foundation is layd by having Exposed the nature & Rules of body, but on y<sup>e</sup> other side, the very discoursing of unseen things is obnoxious to censure, as defering too Much to Incertain Guessing; a cours much spoke against, and for that reason as Much as may be to be declined. Therefore I thinck to dwell most upon generalls, In this discours of fire.

2. Things I find Necessary to the subsistance of fire, the first is air, and that Moving, & the other

## 4. Fire.

a Compressure; ffor out of the Atmospheres force, there may be heat but No fire.

1. It is found by all the pneumatick Experiments that air substracted, ye fire goes out; w<sup>ch</sup> hath given occasion to an Ingenious Comparison of /animall\ life & fire, for the Same disposition of air, maintaines or Extinguisheth both alike; where fire is, animalls will live, but Not where fire cannot be. And Not onely ye air is Necessary but It Must Move, for a meer Stagnum, as In a stopt botle fire goes out;

2. The aire must be Compres't, ffor that keeps fire together in a body; If a fire could be Conveyed out of the pressure of ye atmosphear, It would dissipate. And the difference I find between heat & fire is that the latter hath force, and drives off ye atmosphear, Making a torricellian vacuity. And accordingly the difference between smoak & flame (the latter being plainely ye other set on fire) is No other then this, the former hath all part's Intermixt with the air; and ye latter is so farr from being Intermixt, that as to air it is a vacuity, and with-out a force sufficient for that, smoak will never beCome flame, Nor will any flame be, and No wonder flame is luminous, when it is able to keep off ye atmosphear, but of that In ye discours of light. So are ye burning coals y<sup>t</sup> Glow, and Emmitt an Exhalation However hollowed by ye fire, as charcoal, without any air permitted to Enter, but are clasped about by it with all ye pressure of ye atmosphear.

The Necessity of this Comprest air to y<sup>e</sup> maintenance of y<sup>e</sup> fire in a body, w<sup>ch</sup> Els would dispers, is seen by Com=  
 mon blowing, y<sup>t</sup> is passing a strong stream of air upon y<sup>e</sup> fire; ffor that air is so hard held downe upon y<sup>e</sup> fire, y<sup>t</sup> being moved, rends and tears minutely the body about its Exterior parts, and Exasperates y<sup>e</sup> Motion, and y<sup>e</sup> fire In consequence becomes more furious. And it is also y<sup>e</sup> cours of fire to make an air to fan it self; till It grows violent In y<sup>e</sup> highest degree. ffor the Rarefaction & Exha=  
 lation of y<sup>e</sup> Combustible matter, In going of make's a current by drawing y<sup>e</sup> ambient air, & that [other?]. so that  
 fire hath allwais more, or less air, and when y<sup>e</sup> channells of y<sup>e</sup> matter is opened for air to pass the motion becomes Exasperated accordingly.

This Shows how litle Regard I have to that Notion as hath /bin\  
 and almost yet p<sup>e</sup>vales /is accepted\  
 of Elementary fire, or a substance peculiarly & Intrinsically of that Quality to become fire. And In this more Especially, that No fire Can subsist In the univers but Neer y<sup>e</sup> Center of Some vortex, where the com=  
 mon Recess, carry's off y<sup>e</sup> Matter least, & brings downe, In  
 a way of separation Called Gravity, & levity, that most apt for fire, & y<sup>e</sup> Neerer y<sup>e</sup> Center, the more fiery. ffor there  
 will be a perpetuall Crouding, as wee find Even upon y<sup>e</sup> Surface of our Earth, of a materiall capable of being fired,  
 as y<sup>e</sup> very stones Earth & Mettalls are, and as Some In Scicily  
 by wofull Experience from Mount Etna, know, will some time visit them with Inexorable fire. And this crowding  
 makes

makes a Compressure, w<sup>ch</sup> wraps in any body of Ma=  
 teriall y<sup>t</sup> is agitated to y<sup>e</sup> degree as to become fire, &  
 keeps  
 it together, w<sup>ch</sup> Els at liberty would dissipate, and also  
 fretts  
 it Into fiercer motion's, by waving as wind to & fro; so  
 that  
 If fewel be at hand, ~~suseesip~~ susceptible of such fire, it  
 take[s]  
 and Increaseth y<sup>e</sup> fury. And as at Mount Etna, & a few  
 other places there are tremendous Eruption's of fire, that  
 is Melted Earth & stones, w<sup>ch</sup> runs downe, & makes new  
 promontory's In y<sup>e</sup> Sea, & so Ends; there might be y<sup>e</sup> like  
 all over y<sup>e</sup> globe of Earth, and Not at stated times but  
 almost Continually, according as sulfureous Combustible  
 matter might possibly be disposed. but it ffalls out to  
 be so but In a few places, and at certein times acciden=  
 tally. but yet the multiplication of this Small cittadell  
 of  
 fire, may give us an Idea of an whole globe of the  
 like. And Such I take the Sun it self to be.

The Sun wee take to be y<sup>e</sup> Center of the great vor=  
 tex of our world, Into w<sup>ch</sup> y<sup>e</sup> Gravity (that In generall is  
 to y<sup>e</sup> Sun, & levity from it) hath brought downe all the  
 smaller and more spread & Irregular Corpuscles, apt to be  
 violently moved; It being y<sup>e</sup> property of Smallness to have  
 more Swiftnes of action then greater thing's have; and  
 these (as wee suppose) fall out there to be Mostly of the  
 nature of our sulfur, & firy salts, & other Incentives  
 to fire, such whatever they are as Reside In Mount Etna.  
 And that the body of y<sup>e</sup> Sun, is consequentially a body  
 of fire, most pure & lucid, at our distance appearing /so\  
 but neer hand, If it Could be discerned, probably  
 Consisting  
 all of Etnean fury & Eruption. and Intermixt with lumps  
 some darker & others lighter in monstrous disorder.

It must needs be a lively Imagination to Represent the smoak, flame, nois, rage, heat, Inequality, & perpetuall turning & overturning, of matter fluid & solid, and Never ceasing explosion's, Not onely on y<sup>e</sup> body of y<sup>e</sup> Sun but all over y<sup>e</sup> atmosphear of it, w<sup>ch</sup> is all participant of the fire, and helps in that mass, w<sup>ch</sup> Illumines all y<sup>e</sup> circumjacent spaces. This Image /condition\ of the Sun's condition

tho Cheifly Referred to the Imagination is Not without cogent Evidence of Experiment, that is Gross Irregular & misshapen Spotts are discovered upon the sun's visage, and sometimes places more Illumined the the rest w<sup>ch</sup> they call ~~f-f~~ /maculae & \ faculae; And by y<sup>e</sup> Inequality of their Mo-

vement, comparing the swiftnes In y<sup>e</sup> Midle and at y<sup>e</sup> sides according to y<sup>e</sup> rule of perspective of a Globe turning; It is found that y<sup>e</sup> body of y<sup>e</sup> Sun Revolves In a certein period of time, and that these Inequality's are upon it, and Not /any thing\ swiming in y<sup>e</sup> Ether between. This Rolling

of y<sup>e</sup> Sun is /also\ an Evidence of the turning about of the Ethe-

riall matter, w<sup>ch</sup> Constitutes Its vortex; ffor so it is with

y<sup>e</sup> Earth, w<sup>ch</sup> having a sub-planet y<sup>e</sup> Moon w<sup>ch</sup> turnes about it, must turne also it self. ffor If y<sup>e</sup> Movement be In one it must be in all, becaus Retarding and Exciting of motion by one thing to another Reciprocally must dispers y<sup>e</sup> Movement to y<sup>e</sup> Whole, In a sort of Equatation, so as all free movem<sup>ts</sup> In y<sup>e</sup> World accomodate themselves. And wee have Reason to Conclude, (and who is so senceless to Imagin y<sup>e</sup> Contrary, without demonstration of it.) that the body's of Saturne and Jupiter also Roll about their center, having Sub-planets that doe Most Notoriously declare as much.



Now concerning the collection of this fiery matter to the center of the Great vortex, I must Referr to what hath bin hinted, that the smaller & more Spread & Irregular matter is that of w<sup>ch</sup> fire hath its dominion. ffor Such parts

as are larg & Globular, If such be, It is not conceivable how such can be agitated so as to tear & Rend others or Indeed have any motion Considerable but progressive but long crooked, & Irregular matter moved Must lay hold of other like it, and tear it into a Conformity of movement. Now this matter Must be Neer y<sup>e</sup> center, and that w<sup>ch</sup>, generally, is Called heavy. And so Much of the Grand vortex may be thought to yeild of it, must needs constitute a great body as that of y<sup>e</sup> Sun is, at the Cen=ter. There may be reason why the Sub-vortexes of y<sup>e</sup> Earth Jupiter & Saturne, are less fiery then the Sun. ffor whither taken originally from y<sup>e</sup> Ether In y<sup>e</sup> places where they are, or come from any other place, & settled there, It is not to be doubtded, but the whole mass of them have solidity, with Respect to Gravity & levity, according to the state of y<sup>e</sup> suns vor=tex In those places, and being So farr from y<sup>e</sup> Center, are Made of a matter less Combustible then neerer as at venus, or mercury. ffor If they were More Com=bustible, wee may justly Suppose, they would be driven neer y<sup>e</sup> Sun, and If less, from it. And for that Reason, I account y<sup>e</sup> Earth is More combustible then Jupiter, and that more then Saturne. But y<sup>e</sup> Sun w<sup>ch</sup> is y<sup>e</sup> Center of Combustion, Most of all, and In=deed Nothing Els but fire.

I must thinck of some objections as may be made to this Hypothesis, as to fire. first that It seems heavyness should determine aptness to fire, & y<sup>e</sup> Contrary, of lightness. to w<sup>ch</sup> I ans<sup>r</sup>. That No Combustible Matter is Expresly light, that is Shall Rise to Make way for heavyer to descend, but is all heavyer then air. but that there are degrees of more & less of heavyness In Combustible matter, and Some very heavy, and even Gold is Combustible, as all things y<sup>t</sup> melt are. Some things are lighter then others, ffrom Impediment, as feathers from so very much Superficies as they have. And Mercury Next Gold y<sup>e</sup> heavyest, and most apt to goe into vapour, while Gold will be /all fire & Not\ vapour at all, & yet these two mix as If they were of y<sup>e</sup> Same nature. heavyness is from both Smallness, and Irregularity of parts. but If the irregularity be such as spreads much as /like\ leaf Gold, however heavy, y<sup>e</sup> Impediment hinders y<sup>e</sup> appearance of it, so much as /would be\ If not so Spread. Aptitude to fire, depends on Smallness, and Irregularity of y<sup>e</sup> parts. ffor If small & Globular, /or Cubick\ It must be a violent action to [discerp?] them, for want of hold. And probably Gold may be of Some Such Sort, & mercury oblong. but these are Mystery's as I sayd before not to be discourst but left to thought, becaus they will appear [p<sup>r</sup>easious?] & trifling and yet have Such place In y<sup>e</sup> Imagination & Judgm<sup>t</sup> and they Will Not be dislodged. And I should Not have touched so Much, however litle, compared what I still thinck, If it had Not bin applying to an objection

2. The Greatest objection is from Comets, It is plaine y<sup>t</sup> Comets are body's under a disorder of heat perpetually Smoaking, and not burning out as the Sun. the Evi= dence is, their view as well to y<sup>e</sup> Eye as In telescopes; ffor theyr bodys are Not terminated but ~~shaddowed~~ /as it were shaded\ from the body outwards & /so\ y<sup>e</sup> light ceaseth by degrees, Then this Misty light goes of Continued Into the train and that allwais points from the sun. wherefore No= thing of a Comet is seen but y<sup>e</sup> Smoak or thick Steam from it, and that by mean's of y<sup>e</sup> Sun's light Reflected. Now say they If this fiery matter were heavy, as wee hold, then it must point to & Not from the Sun. ffor ans<sup>r</sup> to w<sup>ch</sup> very many thing's are to be considered.

1. It doth Not appear by any posture of a Comet, of what Nature as to heavy & light y<sup>e</sup> Materiall is, or that It continues allwais y<sup>e</sup> Same weight, If it have any. for wee know Not whence it Comes, Nor whither it goes, but guess it is to & from y<sup>e</sup> fixt starrs. therefore no argument Can be framed from heavyness or lightness about a comet unless it took some station, as y<sup>e</sup> pla= net's have, & so turned planet, whence wee Might Say It is of y<sup>e</sup> Solid/it\y of y<sup>e</sup> place where it settles In Equilibrio.

but as it is It may possibly happen that all y<sup>e</sup> substance of a Comet, as well y<sup>e</sup> smoak or steam as y<sup>e</sup> body is light In y<sup>e</sup> Sun's vortex & Not heavy. And that I Conclude the rather becaus y<sup>e</sup> cours of comets argues as much. ffor the path of a Comet is a trajectoriall line about the Sun. as If one shott an arrow /or bullet obliquely\ over any lofty place

the

&lt;diagram&gt;

the arrow or bullet, would pass in Such a line. as let y<sup>e</sup>  
 high place be C. and y<sup>e</sup> arrow sent from A. It  
 Sall make tour at D. & come downe to B. so  
 a Comet passeth. C. is y<sup>e</sup> Sun. F. G. y<sup>e</sup> Earths orbit.  
 the comet appears at A. and passing about by  
 D. and vanisheth at B. This seems to Me that  
 y<sup>e</sup> Comet moves contrary to its Naturall tendency, but with  
 a vis Impressa, as an arrow riseth; and this vis Impressa  
 is Not subdued till it comes beyond y<sup>e</sup> body of the Sun  
 & then [Returneness?] with y<sup>e</sup> force of its Naturall  
 tendency  
 w<sup>ch</sup> in y<sup>e</sup> Sun's vortex Must be lightness, till It vanisheth  
 by like degrees, as at first it appeared. Now some will  
 say  
 It is strag it did Not Stop sooner; I say No, ffor so  
 great  
 a body as shall be visible beyond saturne, as Comets are,  
 will Not stop in a fluid, as small ones, such as our  
 bullets  
 & arrows are, but persevere in a vast disproportion /of  
 force\ as hath  
 bin Shewed. And yet y<sup>e</sup> steam of it, w<sup>ch</sup> is part's severed  
 and  
 thrown of (by fire, as wee suppose, or ought Els of force  
 to  
 caus it, perhaps whirlwinds & such like disorders) are  
 Instantly stopped by y<sup>e</sup> fluid, and take their Naturall  
 Cours  
 before y<sup>e</sup> Main body can be Reduced. And Somewhat may  
 make y<sup>e</sup> traine a litle Crooked. but Not farther to Refine  
 unless y<sup>e</sup> body and Nature of a Comet were better knowne,  
 (for all that wee doe know of it besides what the  
 naked Eye discernes, is that It makes Entry & Exit In  
 a parabolicall line, or trajectoriall, about y<sup>e</sup> Sun) No  
 arguments are to be grounded upon it one way or other  
 for any thing wee can suppose of it May be, and as  
 Easily be denied, & No mean's to prove either way.

Having here touch't on Comet's I shall Subjoyne ye litle I have to say of them, In tending not any farther Mention of them. and that shall be first that they are truly Errattick, but Not Regulated as planet's, ffor No observation In ye world yet Could discover that they had any rule belonging to them but this trajectoriall passage. It is

to No porpose to produce cartesius conceipt, that they had bin Sun's, and temporised In a vortex, till they were choaked, & ye vortex absorpt, from w<sup>ch</sup> time they become tos't out of one vortex into another, never finding an Equilibrio to settle in, so as to become planets, and If they should happen on such, the Vis Impressa of their Motion conveyed them from it. I say this however Ingenious, Must Not be advanced, so p<sup>r</sup>carious is ye Conceipt. But that It Enters (however It happen's) the sun's vortex, with a vis Impressa, and Returnes with a Naturall tendency, I may alledg reason to hold, from what hath bin touched. And farther Negatively, that It is a vain fancy that they have periodicall Revolutions in Elliptick figures as the planets, tho they have No Concerne in ye zodiack but move altogether Extravagent as to that, yet Sr. Is. N. Contends for it, So app apt are men to frame

hypotheses, while they p<sup>r</sup>tend to decline them, And altho he must admitt the movem<sup>t</sup> parabolicall, w<sup>ch</sup> hath leggs y<sup>t</sup> /opening\ Extend to Infinity, he will fancy that this parabola

by some sort off attraction Shall be made to degenerate Into an Ellipsis, to accomodate his planetary Hypothesis. so Much for Cometts.

But to Returne to our Subject, It is Remarkable that fire hath allways a tendency upwards In perpendiculo, as If lightness were a property of it. And accordingly ye ancients, that Contrived ye 4. Elements, finding that water, air, & earth run together, and fire mounted, Could not shift without an orb under ye Moon of Elementary fire, to answer that, and then it was safe to say, Each Element sought a proper place.

The reason of this mounting of fire, is drawne from ye weight of the atmosphere, for in that Respect all things in it, come under ye laws de Insuperantibus humido. Wee know a blowne bladder put under water riseth with Great violence; because ye bulk of the bladder in water is so much heavier. and a Globe of flame in ye air is of like kind, for within ye limit of ye flame, ye air is kept out by the violence of ye agitation, so against ye air flame hath little or No weight, and by ye flame rising ye water air may, according to its tendency, sink, and consequently that End of ye scale prevails. And farther, since flame hath Not a substance to continue its force long, but devided from the combustible matter strait goes out, wee cannot have ye Experiment of a Globe of flame, or of fire, without ye Concomitance of some weighty body to Keep it  
downe

Downe, flame is allwais oblong and In ye forme of Hair directed upwards; the reason is that It Continually Extinguisheth, and Reneweth, and that makes a Continuall current or stream from ye Combustible stuff, beginning In ye Strongest of ye flame, and ceaseth In an ashy-smoak. W<sup>ch</sup> Current with ye pressure of the atmosphear, draws it forth in length, and makes it play as it doth In vibration's upon ye Spring of ye air, w<sup>ch</sup> may be observed Every night at a Comon candle. So Much dependence hath fire upon ye Comon air wee breath, that here it Could Not subsist without it. And It may give us an Idea how at ye body of ye Sun where must be a greater Compressure. And If it be asked how the fire is Nourished at ye Sun, to Make it perpetual, becaus there is no Example of fire without its pabulum? I ans<sup>w</sup>, there the pabulum Ever Returnes ffor the force of Gravity hath Seggregated from ye rest Into a mass at ye center, of such Combustible stuff, as, perhaps, Exceeds any wee know, If it be [tost?], or (Quasi)Consumed in one place, it setles & Returnes in others, and Gathering In lump's becomes New pabulum ffor ye fire, as soot is No less combustible then charcoal. and so in ye body of the sun, there is a perpetuall Rotation of fewel & fire, alternately succeeding one & other.

What was observed of y<sup>e</sup> rising of flame, is true in all degrees of heat, where it makes any refraction, w<sup>ch</sup>, in tanto, is aeriall void. ffor If the air be any where rarified it becomes lighter, ~~ffor~~ the former reason, according to Measure, taking place. This is found In y<sup>e</sup> German Stoves, and our london Churches. In y<sup>e</sup> former Benches are made In forme of theaters, one above another, and of them y<sup>e</sup> lowest is allwais Coolest, & y<sup>e</sup> highest Most warme. And In y<sup>e</sup> churches y<sup>e</sup> Gallery's are More Sultry In hot weather, then y<sup>e</sup> pew's below. One May observe the smoak from a tobacco pipe riseth very briskly (there being also some Stream thro y<sup>e</sup> pipe) till it Cools, and then it disperses & settles with y<sup>e</sup> air In Equilibrio.

Another property of fire, is to make liquids boyl; that is an Effect of comon, but withall very shallow observation, ffor ffew Reflect so much on it, as to conceiv w<sup>ch</sup> way it Comes about. The best mean's of observing it, is In Glass. And In short the motion of boyling is occasioned onely by rarefaction; but in this manner. ffirst steam riseth, that is y<sup>e</sup> first Symptome of heat. then blebbs of air sett about y<sup>e</sup> bottom, & sides of y<sup>e</sup> vessell, and those by degrees part & rise. at length they part faster & faster, & grow Smaller & Smaller still rising faster and very swift In their motion's at length, & so Continue, till the water falls into a motion Conformable  
to



to the rising of those smalest, and (then) Imperceptible  
 blebbs of air. the fastness and speed of those blebbs ri=  
 sing, & Snatching y<sup>e</sup> water along with them appears  
 at y<sup>e</sup> beginning of boyling, ffor they Strike out of the  
 wa=  
 ter so violently, that perpetuall dropps Shoot out With  
 them, so as holding a candle in a right place, y<sup>e</sup> Rainbow  
 Colours may be seen, as In an artificiall fountaine. And  
 when the body of water riseth with them, w<sup>ch</sup> is /y<sup>e</sup> \  
 Rowling  
 motion wee call, boyling, that darting up of y<sup>e</sup> water  
 ceaseth. ffor the force is lost by the water going along.  
 And this rarefaction at y<sup>e</sup> bottom of the vessel, In very  
 litle parcells, is so violent & Sudden after the vessell  
 is once hot, that it is litle less then an Explosion.

Some liquors that are fibrous as Milk, or Saline as  
 sugar, and many others not so distinguish't will Shew  
 this rarefaction by frothing; for y<sup>t</sup> is y<sup>e</sup> onely boyling of  
 Milk. And Sugar will ffill half y<sup>e</sup> vessell soon With  
 froth; I have seen this practist at Sugar boylers; When  
 y<sup>e</sup> Cauldron is boyled up to the brink, and /becaus\ they  
 Cannot  
 correct their fire /w<sup>ch</sup> is closed in a furnace\, they toss  
 in about a walnut, or  
 less of Butter. and that Reduceth the fury, & abates  
 all the frothing. I p<sup>r</sup>sume it is done by taking off  
 y<sup>e</sup> toughness of the stuff, w<sup>ch</sup> upon y<sup>e</sup> Mixture of Su=  
 gar & butter, becomes rotten, & breaks as fast as it  
 fills, & so no froth, that is y<sup>e</sup> unruly part, stands. but  
 by what mechanisme it is Effected I cannot tell,  
 nor will p<sup>r</sup>tend to that or ought Els of like Secrecy  
 till **Linceus**<sup>134</sup> Enables our Eye sight In seeing so Small

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**134** Lynceus was a companion of Jason on the Argos, reputed to have the ability to see through solid objects. The title page of Hooke's *Micrographia* bore a quotation from Horace's first epistle that would have been familiar to his contemporary readers: 'Non possis oculo quantum contendere Lynceus, Non tamen idcirco contemnas Lippus inungi' ('Your eyes will never see like Lynceus'; still

You rub them with an ointment when they're ill.' Trans. John Conington MA (1869), Corpus Professor of Latin in the University of Oxford. Project Gutenberg. Retrieved 10 August, 2013.) The celebration of eyesight is an index of the new philosophy, from the Roman Accademia dei Lincei, to Hooke's famous methodological dictum: with a sincere hand and a faithful eye.

The Greatest Miracle of fire is, Explosion, of w<sup>ch</sup> that of Comon Gunpowder, is an Experiment so /Gross & \ Notorious Even to Every clown, that wee need No other. But this Wonder is more from y<sup>e</sup> Suddenness then from Strength, ffor the flame of Every candle holds open y<sup>e</sup> almos=  
 phear, an y<sup>e</sup> flame of Gunpowder doth No More. but as comon flame kindles by degrees, as wee see by hol=  
 ding a flame to hot smoak, setting it on fire, but Gunpowder is ordered to flame all at once. and Whereas Comon Smoak is devided Into Insensible Granules, and is weak, for being kindled readily, by want of air, or current /readily \ Extinguisheth; Gunpowder hath a Materiall of more strength & force; w<sup>th</sup> w<sup>ch</sup> and the Quantity firing all at once, Excites that a=  
 mazin<sup>f</sup> force.

The materiall w<sup>ch</sup> makes the force is y<sup>e</sup> Salt, Called niter, or Salt peter; whose shapes wee cannot justly know, but some Guess is had by y<sup>e</sup> shooting in vessells after boyling. ffor the part's Gather together In Cooling, and knott in regular Shapes; that is a property of salts, and even sugar, that hath saline property's. and whatever these shapes are, they prove angular, & None rounding. but Either cubick py=  
 ramidal, octoedral, & y<sup>e</sup> like, and None Either o=  
 vall or Globular. from hence y<sup>e</sup> Safest Guess is that y<sup>e</sup> component part's are angular; but whither of  
 such

Such Shapes, as the Shootings are, cannot be So Surely pronounced, nor doth it Import much. for being Angular that is Sharp Edged and Cornered, they are apter to rarefy upon accension, then More Rotund body's; And this yet more if they are oblong. I conceive there is reason to guess them so, rather then otherwise for Causes and Effect's by Corresponding argue for Each other. But it is Most likely they are neer of ye Same Magnitude & Shape, whatsoever it is, because they fall ~~to~~ together In shooting So aptly. All this admitted It is No wonder that salt fired Shall have more force In rarefying, then a materiall of a less Stubborne sort, Such as wee may suppose Comon Sulfur to be. wee find that Salts Extracted by Strong distillation, for a mild one will Not stir them, will discern mettalls, as ye Comon practis is with Aqua fortis; and with Much More dispatch & Efficacy when heated. all w<sup>ch</sup> argues oblong parts with angles & points, that Insinuating among the parts of ye Mettall divide them. when wee Spoke of Continuity, It was Noted, that If matter were fitted Close together, Great things would Not part them, but drive all together, but very small & pointed stirring one by one, dissolved them, as fire & menstruum's doe.

So much for ye Ingredient salt, or Nitre, to w<sup>ch</sup> onely add that alone it is Inflammable, but Not Explosive. for being fired it will consume by degrees, and onely shake in a lump as it ly's, but Not fly out. The reason of w<sup>ch</sup> I  
take

take to be that y<sup>e</sup> Component part's fitting close to Each other, have Not liberty to Rarefy, w<sup>ch</sup> is done by a freer Motion. But when the part's are Separated by a mixture of other matter, as comonly Is done by Sul= fur & charcoal, All pulverised very fine & Mixed; there is Not such closing of y<sup>e</sup> part's to hinder Each other but all Explode readily. w<sup>ch</sup> Explosion is onely a Sud= den rarefaction. The Reason of sulfur is ready taking fire, y<sup>e</sup> Coal, is tinder, readily to convey the fire, as also

to kindle. but this is Not Enough, for In y<sup>e</sup> powder, If it b[-?] be any thing close crouded, It shall Inflamm but by degrees, w<sup>ch</sup> hath Not the Effect desired, w<sup>ch</sup> is to be obtained by kindling Great Quantity's all at ones, and that is done by Granulating y<sup>e</sup> Mixture, for then, as all round things together, it hath Spon= drill Interstices; by mean's of w<sup>ch</sup> one [corn?] fired, Com= mits a flame thro those Interstices to may others and then more firing kindle y<sup>e</sup> Rest. And by this means So great a Quantity rarefy to gether, & make that wonderfull Explosion, wee know from y<sup>e</sup> use & practise of this demoniacall dust.

In fine there is Nothing wonderfull In Explosion's, w<sup>ch</sup> is Not

y<sup>e</sup> Same as In Comon rarefactions, the difference is onely In sud=

denness, w<sup>ch</sup> Exciting a Swift motion in body's of weight and artificially disposed, they move with perseverance according to their weight, and make strang Impressions.

All w<sup>ch</sup> is an art Called Gunnery to Contrive with advantage

But

But ordinary Rarefaction will burst strong vessells, If heat be accordingly applyed thro them to y<sup>e</sup> Inclosed air, bladders May be made to burst, and vast weights will a flaccid bladder rais, If made turgid by Rarefaction, but this is a slower process; but yet the most violent Explosion's may be Imitated by air rarefyed, as the windgunns, artificiall fountaines, and other pneumatic contrivances shew. therefore wee are to look into y<sup>e</sup> Reason of rarefaction In generall, ffor the force of Explosion's, as well as Into that of ~~comp~~ Combustion, ffor that is but the Extream of rarefaction, and all degrees of rarefaction proceed from Corresponding degrees of heat. let the Instance of fair water Shew this; ffor upon application of heat It begins to Evaporate, but Gradually so that /y<sup>e</sup> Steam\ If Inclosed, ~~y<sup>e</sup> Steam will~~ /hath force to\ Rays water Steeple height, as the fire Engin shews. And throw a /but a few\ drops of water Into a pot of melted Glass In a furnace, It is rarefyed /almost\ all at once, and So Shoots Into y<sup>e</sup> yeilding Metall. and that rarefyes it more; having perhaps let in Some unrarefyed drops also into y<sup>e</sup> cavity, w<sup>ch</sup> as soon become air, and demand 50<sup>ty</sup> times y<sup>e</sup> Space, what is the consequence? but disroofing furnace, hous and all; & sending y<sup>e</sup> burning Glass about y<sup>e</sup> room, as If satan himself were at work there. ffor water Is incapable of burning but will be Exceeding hot, and turne Into air, w<sup>ch</sup> they Call boyling away, and If urged by Excessive heat Explode, as was sayd before.

Then searching where to find the great power of Rarefaction, I am led to thinck it depends Not wholly on the Immediate materiall, w<sup>ch</sup> gives us the discovery of it. as for Instance air In a bladder; that Immediately Swells and turgifies y<sup>e</sup> bladder, but it is forc't by all the Circum=  
 -Jacent metal matter, w<sup>ch</sup> passeth & Repasseth y<sup>e</sup> bladder. And then there is a larg Sphear, w<sup>ch</sup> may Easily be Imagined, to Supply a force, adequate to any Effect of rarefaction. As for Example, when a bladder is Griped in y<sup>e</sup> hand, being half ffull of air, & so held to y<sup>e</sup> fire, the hand Shall percieve the strength of the rarefaction Excited by the heat. Now if it were possible to Collect all the force of y<sup>e</sup> Severall strokes of y<sup>e</sup> parts w<sup>ch</sup> Constitute y<sup>e</sup> fire & air about y<sup>e</sup> bladder, thro all y<sup>e</sup> meandrous direction's as it passeth; It would make a larg accy<sup>o</sup>. ffor Every part of y<sup>e</sup> Combustible matter thro y<sup>e</sup> air, & Every part of that, send, by Continued strokes, from one, to another force, applyed by strokes upon Every part of y<sup>e</sup> Included air, Exciting in that an action tending to Expand, answerable to y<sup>e</sup> content of y<sup>e</sup> force thus ledd to & opperating on it. So It is Not y<sup>e</sup> air of /in\ y<sup>e</sup> bladder, but the fire and all y<sup>e</sup> heated air about it, y<sup>e</sup> creates the Extension perceived by y<sup>e</sup> hand. as It is Not y<sup>e</sup> lever that lifts y<sup>e</sup> weight but that force that actuates y<sup>e</sup> lever. I know it is hard to bring so much together In y<sup>e</sup> Mind, but really If it be considered, that all that fire & air are In Extraordinary agitation and Strike about Every way, & y<sup>e</sup> force of No stroke is lost, It may well be thought y<sup>e</sup> air in y<sup>e</sup> bladder hath its

share.

Share /of y<sup>e</sup> force\ w<sup>ch</sup> is Not gaged more by y<sup>e</sup> Quantity  
 within then  
 by that without, so much more competent. And becaus  
 the effect of that without is Not perceived but /y<sup>e</sup> force  
 of\ that in  
 y<sup>e</sup> bladder, by means of holding it, is perceived, wee are  
 apt to thinck, It is strang an handfull of air Should be  
 so Strong. It may be Questioned What Should convey, or  
 Communicate this Motion thro y<sup>e</sup> sides of y<sup>e</sup> bladder? I ans<sup>w</sup>  
 a matter more subtile then air, and permeats readily  
 y<sup>e</sup> Substance of y<sup>e</sup> bladder. If they ask, whither that be  
 air  
 & Compressible or Not? I ans<sup>w</sup>. I know not, but is is  
 possible,  
 It may have y<sup>e</sup> property's of air, and Not be So Small, as  
 some is, however being free, & Not Comprest as air is,  
 there  
 is No Experiment of its property's otherwise then as it is  
 found to transmitt action thro vessells, w<sup>ch</sup> to Comon air  
 are Impervious; The fire agitates the whole air, Small &  
 Great, and the smaller thro y<sup>e</sup> sides of y<sup>e</sup> bladder agitate  
 first y<sup>e</sup> smaller within, & then that /agitates\ y<sup>e</sup> Greater,  
 & so y<sup>e</sup>  
 sides are borne out. This is y<sup>e</sup> Cours of Comon  
 Rarefaction.

But it will be sayd what is this to explosion, as Gun=  
 powder, at y<sup>e</sup> touch of a most Minute spark, Explodes  
 and If an Island, continent, or Globe of y<sup>e</sup> Earth were  
 all of y<sup>e</sup> Same materiall as Gunpowder, a single Spark  
 that hath No Comparative force at all, would serve to  
 dissipate it all, with Incredible [frager?] & violence. It  
 is plain  
 that this force is Not derived from y<sup>e</sup> Spark, for that  
 hath  
 None. therefore it is absolutely Necessary to Conclude  
 that  
 There is a perpetuall agitation In y<sup>e</sup> subtile matter  
 of the world, w<sup>ch</sup> will rarefye some sorts of matter, w<sup>ch</sup>  
 is of

is of forme, size, & mixture, apt for it. And then If a Start  
 be given by y<sup>e</sup> accession of a small part, whereby the subtile matter may act, as the accession Continues, the like action follow's it, and goes thro.

But yet the Question Returnes, how the Subtile Matter can act upon part's kindled, and Not kindle them? that may happen becaus the subtile matter is dispers't, & broken by the Intermixt air, or Grosser Matter; but when a part is kindled, that is put in Motion, y<sup>e</sup> Subtiler Matter is Collected, and y<sup>e</sup> Gross air throwne off; And then cooperates with y<sup>e</sup> movement of the combustibile materiall, & gives it the Quickness & Strength seen In y<sup>e</sup> Explosion. And the Combustible matter of Gunpowder, being larger then the Subtile matter that act's upon it when the air is thrown off, It is no wonder, that It is not originally Excited to move, by it; as It will not, If put in y<sup>e</sup> Exhausted Receivour, a torricelian vacuity, but when once put In motion It cooperates & augments it. This discour Refined as it is hath fair Experiments to give it Countenance. As the fire of flame will scarce, and Not under long time, break y<sup>e</sup> body of Gunpowder So as to make it ~~Explode~~ Explode. And the sun beam's, tho Contracted by a lens to a stong heat but melts it onely; but the least portion of melted steel, as fly's of In striking fire, or Spark of wood, In an Instant fires it. w<sup>ch</sup> shews that aeriall matter



Matter, tho ~~Mixt~~ with /derived from ye\ terrestriall, as flame, doth Not break ye body of Gunpowder, and thro a burning Glass tho it use acts, it is languid, but Culinary fire Wholly terrestriall, act's with violence & soon dispatches.

Now when air is rarefyed by heat, as In ye Instance of the bladder, It is manifest, that ye Influence is limited, to the sphear of ye fires activity; but If there Come an Influence from ye Subtile matter of ye world, such as by forme and disposition of parts Either of ye com= bustible matter, or of the Subtile matter or both ffitting Each other's motions, so as upon Intrmission of it, they Reciprocally act, & ye former is aided and accelerated as wee see in Explosions, and what is sayd of Gunpowder may not be Inept to all other signall Explosion's, as aurum fulminans<sup>115</sup> & ye like. But This influence of Subtile matter aiding and accelerating ye motion of some fewell put in action to a degree of fire, may derive the force and power from such a vast sphear or space round it, that any violence from thence may Not reasonably be wondered at.

And this Subtile matter, w<sup>ch</sup> hath Such furious effect's In Explosions's, and other Extraordinary Incidents In ye world of w<sup>ch</sup> wee are able to give No account, I shall Call the Spirit of ye world, Not after ye Spirituall fancy of the anima, of plato, Nor the dull animus of lucretius; but plaine Mechanisme after the laws Com= mon to Quantity, small or Great. Onely what In our Experience & language is much, In this hath Equality /by\ Many.

---

<sup>115</sup> lit: 'exploding gold'. Fulminating Gold was discovered by alchemists who dissolved gold in Aqua Regis (nitro hydrochloric acid) precipitating a powder which proved sensitive not only to heat, but also to vibration. This was the first high explosive.

To Mr .....<sup>117</sup>

Sr.

The occasion.

Since you are pleased to think that short  
 acc<sup>o</sup> I gave of the Late Nocturnall Illumina=  
 tions Not unfitt to be Subjoyned to the wea=  
 ther Gager, being Congruous to y<sup>e</sup> Subject  
 of that undertaking, and withall y<sup>e</sup> /thing\ it self  
 so Extraordinary, that it is doubdtfull Whither  
 the like, In our parts at least, was Ever  
 seen before: I have taken the freedome to Sett  
 downe what I observed a litle more Carefully  
 and deliberately then by that paper was  
 p<sup>r</sup>tended /to be done\ being done<sup>118</sup> (~~as I may say~~) upon  
 the spot/, \ and with very litle Reflection  
 Such as Men Expect Should accompanue  
 observations of that Nature.

2. The Notice  
 had of the  
 lights appearing

Upon Tewsday. 6. Mar. 171<sup>56</sup>. at Neer  
 8. In y<sup>e</sup> Evening I was Called out by a boy  
 In a great fright, to see, as he Sayd, the  
 Strangest things that Ever were seen.  
 Upon this Sumons I went abroad & found  
 all y<sup>e</sup> family staring about upon the  
 skie

---

<sup>116</sup> From here on, as earlier, BL pencil numbering has been crossed-out, starting at 29 and running on to 38 on 133r.

RN's own numbering is also crossed out on the rectos.

<sup>117</sup> To whom? William Denham? then why no reference to his title; Edmund Halley? he wrote the standard account for the Royal Society. I cannot trace the 'Weather Gager' reference.

<sup>118</sup> The word 'done' scraped-out, as is part of the following crossed-out phrase (including the crossing-out line!). I draw attention to this as it is an unusual example of scraping back in RN's MSS.

Skie, and as y<sup>e</sup> way of y<sup>e</sup> Comon people upon surprising occasions is, full of alarmes, Extasies, & Ejaculations. Soon after the Minister of the towne came downe, having left his Neig[h=] hours in like ~~condition~~ /state\ assembled about his ho[me] and In the churchyard; they Expected it seem[s?] from him Either Interpretations or Consolatory discourses ~~from him~~ proper to the occasion I stood with them about half an hour, and what I saw in that time, as well as I can describe it was as followeth.

3. The pha<sup>ee</sup> nomenon it Self described.

There was a fixt and strong light In the N. & N.E. w<sup>ch</sup> seemed very like break of Day And from thence (cheifly) divers stream's or rather detatchments of Moving light derived and spread about Every way, to the E: S.E: & S. Whereof the cheif Remarq I made was that these lights were in Continuall Motion and chang, and In y<sup>e</sup> process of them took divers formes seldome continuing in any one long, but faster or slower allwais (as I sayd) changing, and so at length one after another they wasted. And Not onely from y<sup>e</sup> N. & N.E. but all  
over

over the skie, as to y<sup>e</sup>. E: S.E: &. S. lights  
 here and there Emerged, and proceeded va=  
 rying till they wasted, and others In like  
 manner Succeeded. Sometimes they began  
 and spreading devided; and Sometimes, ob=  
 long, like the Edg of a thin gilded cloud  
 In the Sunshine, with a spice of y<sup>e</sup> Rainbow  
 colours; these also devided disperst and  
 wasted; And I took Notice that y<sup>e</sup> devided  
 parts many times took a place as a cen=  
 ter, and from thence<sup>120</sup> radiated round Exact=  
 ly like y<sup>e</sup> breaking of the Suns light thro  
 clouds, w<sup>ch</sup> they call sun-beams, and I can=  
 not say those centers and Ray's Stood  
 still, but were /rather seemed to be\ all In /some\ Motion  
 together /\*\. And /that\  
 w<sup>ch</sup> was all along Most strang, was a ge=  
 nerall waiving of light appearing as /if some clearer  
 lights lay\ beyond  
 a Mistyness In the ai~~r~~ Superior air w<sup>ch</sup>  
 Resembled the heaving of Great watry sur=  
 faces. And I saw /as from behind the misty air aloft\ many  
 apparent Explosions  
 not as tempestuous lightening, darting strait,  
 but plain round Kindlings, as of Gunpowder  
 or other Explosive matter, ~~that~~ /of w<sup>ch</sup> y<sup>e</sup> light\ appears  
 and are /is\ soon gon; These happened here  
 there, and there, rithmically, as I thought,  
 and

\*

Nor could I dis=  
 cerne that these  
 movements held  
 to any paralel=  
 -lisme, as caused  
 by any wind but  
 were as contingents<sup>119</sup>

<sup>119</sup> Note added later, in grey ink (as are several alterations in the text as a whole, and as are the two alterations immediately following the asterisk in the text)

<sup>120</sup> 'from thence' written over scaped-out previous wording. Much scraping out around the corrected passage below, following the asterisk.

and while they lasted (I saw of them/, \ but twice) very much Resembled the view of platoon-firing /excepting Ranks & distances\. These are the cheif pha<sup>e</sup>no=mena I saw, whereof some other circumstances I shall touch afterwards; ~~but after~~ /at about half an hour pa[st?]\ 8. when I thought y<sup>e</sup> Meteor was wasted I Retired, but have bin Since Informed that at 7. It was much stronger, and so about. 12. and. 4. Morn, when y<sup>e</sup> lights, as they Sayd, were More Egregious, and y<sup>e</sup> proceeding of them more considerable, with divers Incident observations stranger then any I could make; And It is to be p<sup>r</sup>sumed y<sup>e</sup> spectators of them will think fitt to Communicate what they saw, and can attest without Magnifying or disguising any thing as ~~freely~~ as I have done here, /of\ <scraped-out> what fell In my view, and hath witnesses Enow to attest it.

4. the Condition of the Skyes, at y<sup>e</sup> time.

The condition of the Skie at this time was as when thin misty clouds p<sup>r</sup>vaile, w<sup>ch</sup> are very high, and by y<sup>e</sup> Country men are Called mares tailles; Sometimes wee might see a starr or two & then againe None, and often near the beginnings of a light there was a great opacity /(as seemed)\ of cloud, & that was Comonly a signall of a light Coming, but that /light\ Soon got

got the better spreading about, & disper=  
sing the dark cloud, so as it did not appear  
what became of it. It was told us that at  
7. the lights were redd, but in our view  
they were whit, as when the Sun Shines  
upon the Mares-taile-clouds and they seem  
as flaxen. No place was perfectly clear  
from this Mixture of thin cloud and Mo=  
ving lights, but due. W. Where venus shone  
bright, and there was a /faint\ crepuscular light,  
but the Sun was too farr dip't to Influence  
at all /by Reflection\ towards y<sup>e</sup> N. N.E. & other points  
where these lumination/'s\ appeared, unless /upon bodys\  
/If any lay\ further off In the Conick Shade, then wee  
Imagin any cloud, or Meteor Can Come.

4. In striktness  
not solvable  
phisically.

Now [S<sup>r</sup>?] admitting (What I doe not here  
controvert) that this appearance of light In  
the heaven's was an Effect of Naturall Causes,  
I may with Confidence affirme, that No man  
can give a just phisicall account of it, that  
is what y<sup>e</sup> luminous Matter was, whence  
derived, and how wrought upon to lighten  
In this manner? ffor y<sup>e</sup> Seat as well as the  
substance of it was certainly beyond the  
Reach of all our Experiment of sence, or  
knowledg; And those who p<sup>r</sup>tend to solve it  
let

Let them Set what price they pleas upon their  
 doctrine, are No better then Mountebank's  
 that give out upon Stages Strange Nostrums  
 and Cures; what Els is all y<sup>e</sup> Cant about  
 Nitre, Sulfur, vapour, & such like Confused  
 Ideas of Imaginary Agents, that /granting all they say\  
 afford not  
 y<sup>e</sup> least Explicable practise of any thing?<sup>121</sup> and  
 yet the chimeriq discours shall demonstrate  
 what hideous tempest these Ingredients had  
 raised in a more southern clime, but here al  
 tho they flowed upon the dissolution of the  
 Great frost, the cold air had Nip't their force,  
 and made them onely shine a litle? Tis true  
 /about 2. months before.\ there had bin a great frost; and  
 so after  
 Tenterden steeple was built, Goodwin sands  
 appeared; there has bin formerly great frosts  
 and many dark nights /have\ past since y<sup>e</sup> last,  
 but No lights of this kind were Ever seen  
 here before; and what is all this to the Ques=  
 tion; why now more then at other times, on  
 like occasion's, lights should appear?

6. An attempt  
 at distance  
 tending to it.

But Not wholly to decline all phisicall  
 discours upon this occasion, I shall venture  
 So farr therein, as Seem's to Me reasonable.  
 I Grant that physiology scarce p<sup>r</sup>tends to  
 Explicate directly any thing that lyes  
 without

---

<sup>121</sup> Reference here to chemical (or alchemical) theories descending from Paracelsus, *Meteora*, 1556, -> sulfur-nitre theory John Mayow, Robert Hooke, Gassendi, etc, right through to (and incl.) Newton; John Woodward, *Essay*, 1695; see Jankovic, p25ff. RN begins inserting the learned excesses (note the pun on chemic/chimeric) which undermine his own authority as an unbiased oberver, and go beyond his ostensible intension of describing the event.

without the pale of sensible Examination  
 or Experiment, yet Speculatively It may Im=  
 prove sensible knowledg In a process of  
 transferring Ideas of Consequences from things  
 knowne, to others Similar, but less Cognoscible.  
 Whereby Experiment still Governes, and the  
 cheif Result is the avoiding confusion, and  
 distinguishing what is really Extant In Na=  
 ture, and /what\ is onely opinion depending on vulgar  
 p<sup>r</sup>judices & mistakes, or y<sup>e</sup> frothy language of  
 some vertuosi; And accordingly ~~In this Instance~~  
 I shall Endeavour to bring this strange appea=  
 rance neerer our view, and by applying In=  
 Stances of things knowne & congruous, render  
 the parts of it a litle more familiar to our  
 understanding. And In doing this, I shall  
 Not Supplant any Religious, or Morall Con=  
 sequences, but hope to raise them Into as great  
 an height & conspicuity as My better's can es=  
 pect /& as I hope\ and /se\ will /be made\ appear before I  
 have done.

7. ~~Conjectures in~~  
~~as to particu=~~  
~~lar.~~ the Nature  
 of the lights, by  
 Comparison

In the first place the lights were more  
 Conspicuous becaus as y<sup>e</sup> aspects of y<sup>e</sup> great  
 planets then were y<sup>e</sup> Night was very dark.  
 It may be that In day light, or In Comon  
 moon-shine, they had Not bin discernable.  
 and If any one say's that y<sup>e</sup> like may  
 have



have bin /happened\ before, but for that Caus Not taken  
 Notice off, I ans<sup>w</sup>, that /it\ May be so, and what then /a  
 posse ad esse Non valet arg:\  
 But to proceed, these lights Coming up to the  
 degree of Moon shine, as apparently they did /and scarce  
 higher\  
 Wee Must Range them among the more ordi=  
 nary Corruscation's seen In dark nights, to w<sup>ch</sup>  
 ffor the Great variety divers Names have bin  
 given, as falling starrs, lightning. &c. whereof  
 some Notice is taken in the foregoing papers.<sup>122</sup>  
 But all of this kind are very different from  
 fires, and tempestuous Eruption's; for all those  
 are violent and assimilating, or Corroding, but  
 these have litle or No effect upon any /ordinary  
 combustible<sup>123</sup> [---?] Mat=  
 ter that falls In their way. Therefore Natura=  
 lists make a distinction between /fires ardent\ Culinary &  
 lambent fires, w<sup>ch</sup> is /very Just, but\ Easier /to be\  
 observed then /it is to be\ deter=  
 mined wherein Either Consists. The lambent  
 fires give light Enough In ye dark, such as ye  
 S<sup>t</sup>. Elmo, or Castor & pollux, and the /like w<sup>ch</sup>\ appear  
 about animalls In various Manner's, and it  
 May be ~~that~~ /doubtded whither\, Since /animal\ life is /it  
 self is a fire\of this ~~this~~ kind whi  
 /(\If our sence of seeing were Subtile Enough /to discern  
 it)\ any  
 living Creature is not more or less luminous.  
 But it is not at all strange, as hath bin Noted,  
 that the air Containing all sorts of spirituuous  
 as well as terrene substances /certein\ confluxes of  
 Similar matter should hapen, and /such as\ being of  
 natures

<sup>122</sup> RN has mentioned an earlier communication, above. Perhaps he is referring here to another a version of the text sketched out at f. 142r?

<sup>123</sup> Here and below either further evidence of rubbing - or maybe damp. Also on opposite page.

natures Incompatible as acid & Alcaly [~~---~~?] w<sup>ch</sup> perpetually operate to destroy Each other /should upon their occurring have y<sup>e</sup> like Effect\ and from thence accention's, and luminations of the Innocuous & pacifick sort proceed, [..?] are / (2)\ occasionally / (2)\ perceived, when darkness / (1)\ favours. And Now having drawne this Notion of lambent fire and its Corruscations downe to a paralell with the Comon Instances of y<sup>e</sup> like, as I may say, under our Noses, wee are at y<sup>e</sup> Ne plus ultra,<sup>124</sup> and Shall offer at No Explication of thing, w<sup>ch</sup> I know is Not, (clearly) to be had, but proceed to y<sup>e</sup> Case of the p<sup>r</sup>sent Illumination.

8 ~~The generall particular occasion so lutions offered.~~  
The phenome=  
na considered  
by parts.

And I take the Summ of that to have procee=  
ded from certein collection's of spirituou matter  
In y<sup>e</sup> air, gene=/rated as\<sup>125</sup> vegetative slime /gathers\ In  
standing wa=  
ter, and meeting /with\ what causeth slight accensions  
~~of it,~~ appear'd to us in those Corruscations. the  
Aurora in y<sup>e</sup> North Seem's [~~---~~?] Made up of y<sup>e</sup>  
Great Number of accensions /towards\ that way /Region\  
and  
by mean's of y<sup>e</sup> perspective view, w<sup>ch</sup> terminates  
distances In the horizon, became /to our view & thought\  
as one Conti=  
nuall Shining, of w<sup>ch</sup>, ~~No /in that distance perspective~~  
~~view~~ the minuter\ Movements were /Not\  
perceived; but as The Corruscation's fell out  
neere /to us\ they seemed to flow from thence, and  
approaching y<sup>e</sup> zenith were very distinguish=  
able in ~~Every~~ /most\ Circumstances of them. the  
wavings

<sup>124</sup> i.e., 'nothing more beyond', traditionally a phrase identified with the Pillars of Hercules, thus, marking a boundary.

<sup>125</sup> Some scraping here - the original wording was erased and this inserted.

wavings of the light came from accension's at a vast height /in divers Remoter Horizons\ whereof the centers /of w<sup>ch</sup> Emergent lights\ by reason of y<sup>e</sup> Misty Clouds /and the rays falling obliquely upon them\ were Not discernable, but these falling /in time\ close one after another, cast a light with successive Intervalls, and [.....?]/so in y<sup>e</sup> Capacity of\ our

Sence /formed\ that Image as of waiving, [.....?] rather unda, then undula<sup>e</sup>, as some have Named it.

And this is confirmed by those accensions of w<sup>ch</sup> we manifestly saw the capita or centers Succeeding one and other /w<sup>ch</sup> In other places might conduce to y<sup>e</sup> waiving\ ~~ffer~~ /and\ had /not\ those bin so distinctly discernable, the shinings of them /(as of y<sup>e</sup> others, not seen) ~~being~~ dashing\ east thro the fissures of y<sup>e</sup> Mistyness,

\*q<sup>a126</sup>

And a Sea fight  
In y<sup>e</sup> Night (If such were) would to y<sup>e</sup> people /ashoar\ beyond y<sup>e</sup> hills In ~~an~~ would Shew thro the Evening Mistiness such heavings, w<sup>ch</sup> /onely\ proceed from Successive but Numerous accensions.

would have Represented the /like\ heavings, as of water.\* These lights may be Called moving /w<sup>ch</sup> I ascribe much to the various positions of y<sup>e</sup> changing of y<sup>e</sup> misty air\;

there were other's of longer continuance; as those that had y<sup>e</sup> Corona of Beam's, and the the spreading beginnings w<sup>ch</sup> I mentioned /before\; but It is harder to find Resemblances in any of our ordinary phenomena whereby to Conceiv y<sup>e</sup> Manner of them. I have seen sometimes towards Evening a very strong light In the air, w<sup>ch</sup> hath Not Shott (as they terme it) but Stood still, as a thing that Kindled, and Consumed; and y<sup>e</sup> lustre of it was very strong, but I know Not with w<sup>ch</sup> of y<sup>e</sup> Names mentioned In authors, it agrees best. These

continuing

<sup>126</sup> There is some mark, asterisk-like, by the q<sup>a</sup>, and an asterisk in the text.

continuing and lively Corruscations, whither they began round or oblong /probably\ were of that nature. but somewhat of y<sup>e</sup> misty clouds often offuscated them, Especially those w<sup>ch</sup> were round and Radiated. The Caus of that forme I take to have bin pure distance; for y<sup>e</sup> lumination being very high (of w<sup>ch</sup> afterwards) and coming towards /us\ thro the broken misty air, as it approached, seemed to spread and y<sup>e</sup> beam's at y<sup>e</sup> Remoter Ends were broader /like y<sup>e</sup> Sailes if Some windmills\ all w<sup>ch</sup> the rules of perspective Require, and In plano seem as Rays about a Center, Just as when one looks thro an hollow trunk or Cane, y<sup>e</sup> sides are as Rays from y<sup>e</sup> light Entering at y<sup>e</sup> remote foramen, and so In picture /it\ must be Represented.<sup>127</sup> The oblong lights Comonly began at y<sup>e</sup> border of an Opac cloud; w<sup>ch</sup> probably was /but\ a very lively corruscation, of w<sup>ch</sup> the center was obscured but y<sup>e</sup> light Came to the Edg, and there, after y<sup>e</sup> way of Halo or parhelion-Circlings, underwent some Refractions and had some Colours attending. And Much of the breaking & dispersing of y<sup>e</sup> lights may be owing to y<sup>e</sup> unaccountable Misty clouds, w<sup>ch</sup> were allwais Moving, & breaking. and it is certain that beyond & amongst them were  
numberless

---

<sup>127</sup> RN makes great play here and below of the possibilty of 'fixing' the distance (and scale) of the lights by reading the perspesctival rfeatures accurately.

numberless lightnings of various sorts & formes  
 of w<sup>ch</sup> Our observation gave No account at all  
 but onely by y<sup>e</sup> comon disorder & motion of  
 light's & darkness In y<sup>e</sup> Skies.

9. The scituation  
 In y<sup>e</sup> Atmos=  
 phear, and  
 N. winds the  
 generall Caus.

O see No reason but /after others\ I may p<sup>r</sup>sume to offer  
 My  
 conjecture touching the generall Caus of this  
 Coadunation of Innumerable lightnings. first  
 they were Certainly very high In y<sup>e</sup> Atmosphear  
 w<sup>ch</sup> y<sup>e</sup> opening of y<sup>e</sup> beam's proves; for those Could  
 not Spread so much In y<sup>e</sup> perspective view w<sup>th</sup>=  
 out a Considerable run; and y<sup>e</sup> Nearest, y<sup>t</sup> is  
 y<sup>e</sup> broadest part of them was certainly ffarr  
 Enough off; and an acute observer, by the angle  
 of their Inlarging Might Guess at y<sup>e</sup> distance  
 from y<sup>e</sup> luminary. But what proves it more  
 plainly is that y<sup>e</sup> lights were seen In most  
 parts of England at y<sup>e</sup> Same times, as accounts  
 I have In wrighting, & creditable Relations shew.  
 comon tempests, of w<sup>ch</sup> 10. miles off there is Scar[ce?]  
 any account, (Comparative with these,) creep  
 upon the Ground. Now to Resolve this grand  
 Quere, how such things might happen? I must  
 have Recours to my Barometer, and concur=  
 rent state of y<sup>e</sup> weather abroad. And from  
 thence I conclude that /~~the~~ from w<sup>t</sup>ever caus it was\ Wee  
 had discharged  
 upon us, the whole volume of Northern and  
 Easterne

Easterne air; But /at that time\ the south & west, were in  
 possession with such a body of force, as Could  
 not /readily\ be Removed, but, /upon ye ~~conflict~~  
 opposition\ this Northern air was  
 diverted & spent it self upwards In the  
 atmphear, And /ye force of both breaking upwards\ ~~there~~  
 ye Conflicts were, in  
 an height So great, that Nothing humid  
 could be ye Consequence of it. If ye Northern air  
 had dispelled ye westerne, wee had then had  
 abundance of Snow /or\ raine, as fell out In ye  
 former attaq, w<sup>ch</sup> made the Great frost & Snow,  
 ffor that took place below. And it is observed  
 y<sup>t</sup> /winds or\ weather Returne often after ye Same Man=  
 ner. but here Instead of taking ye place of  
 clouds, & rain, w<sup>ch</sup> is allwais near ye Ground,  
 It was lifted up into a rarity that did Not  
 admitt such discharg, but from that post of  
 Spirituous & rarified Materiall, sent us /downe\ the  
 notice by /these\ corruscation's & lightnings, other then  
 w<sup>ch</sup> could not be ye Consequence of disorders there,  
 I will readily grant that the Northern re=  
 gion's have more of spirituous coagulums In  
 the air /then the Southern\ as Standing water Gather's  
 slime More  
 then Currents; ffor In ye tropicall zones /besides heats y<sup>t</sup>  
 disperse\ the very  
 trades purge ye air; This may be a Caus why  
 ye artik region's are more famous for Meteors;  
 and /even there\ wee Seldome observe any /ordinary\  
 Corruscations

but unless

10. proved by  
Barometrick  
observations.

\*  
and so In this  
Juncture it fell  
out, for In Con=  
sequence the  
North & E. winds  
p<sup>r</sup>vailed, and  
have Continu=  
ed with us Ever  
since, and with  
So litle check, as  
shews it was at  
first a generall  
access.

/unless\ it be In a Calme time; But of these affairs wee  
Want  
a good Naturall history, and becaus so much of  
a just and acute genius ~~to observe~~ is Required  
to /observe and\ make y<sup>e</sup> Collection wee have Small Reason  
to  
Expect it; and unless very well done its better to  
have None at all, w<sup>ch</sup> will be grantd when it is  
considerred how much of fable /is\ crept Into y<sup>t</sup> litle wee  
have.

Upon this tewsdays & some time before the wind  
had bin all at west, and on that day particu=  
larly very calme & tranquill, and also that af=  
ternoon warme, & without any symptome of a  
Northing wind, ~~but~~ /Except\ In the Barometer w<sup>ch</sup> had  
for divers day's before was rising and then  
also was rising & stood high In y<sup>e</sup> North wind  
[place?]. In w<sup>ch</sup> Case I have Ever observed the  
North to gaine, and some way or other wee /soon after\  
have  
heard of it.\* Now here, as I observed, the North  
Came on as y<sup>e</sup> Mercury signified, but /it\  
Expan=  
ded wholly aloft, and did Not protrude y<sup>e</sup> air /from\  
below; So wee Could be sensible Neither of  
any Cold, Nor humidity, Such as flows when a  
North p<sup>r</sup>vailles ~~below-an~~ /over\  
a warmer air /below\  
pro=  
pelling or Mixing with it. And /here\  
the juncture  
or border was very high & not laterall but  
Horizontall, beneath w<sup>ch</sup> that misty clou=  
diness (thro w<sup>ch</sup> wee saw these lights) was bredd.  
but

but In so very great height those were then  
 and Higher /In y<sup>e</sup> atmosphear,\ the Expansion of y<sup>e</sup> air  
 was /so\ very  
 great, and y<sup>e</sup> weight upon it /so very\ as litle [and?] /  
 that\ what  
 disorders happened, must (as one ~~would~~ /may reasonably\  
 guess)  
 be of y<sup>e</sup> genus, Not humidum, but luminosum.<sup>128</sup>

11. Not frequent  
 as the Autora  
 Borealis.

This, S<sup>r</sup> is the acc<sup>o</sup> I have p<sup>r</sup>sumed to trouble you  
 with of this Illumination; I know you will say  
 It is rude, & I fear Ignorant, and y<sup>t</sup> the Subject  
 deserves one Much more accurate, all w<sup>ch</sup> I most  
 readily Grant, and /s\lso\ that If of y<sup>e</sup> many observers,  
 those that are more Capable mean as well as  
 I doe, you will soon have /a\ better. I have hearken=  
 ed after such, but as yet perceiv onely some  
 Buzzing as if this matter of great amazem<sup>t</sup>,  
 were onely an amuzem<sup>t</sup> fancy, being a ~~most~~ /but\ an  
 ordinary Spectacle in y<sup>e</sup> northern Coun=  
 try's; /It is adopted\ by y<sup>e</sup> Name of Aurora Borealis, with  
 y<sup>e</sup>  
 stria<sup>e</sup> & undula<sup>e</sup>,<sup>129</sup> and /those they say are\ by some seamen  
 Called  
 the Dansers. Whither those and these are alike,  
 I am Sure none that hath not seen both, Can  
 tell, therefore /as to particulars\ I am Not Competent to  
 say  
 any thing of y<sup>e</sup> matter. That y<sup>e</sup> Artick Coun=  
 try's have More of Meteor. I have already ob=  
 served, and It is well knowne that there,  
 The midnight twilight is as strong as our  
 Aurora; And /In all places\ it happen's often that by  
 reason  
 of some sort of thickness in the air, the  
 twilights

---

<sup>128</sup> i.e., 'not damp, but luminous'

<sup>129</sup> Stria means 'streak' (a term used to describe the dust tail of a comet), undula means 'wave'.



twilights Shine much stronger then ordinary.  
 And /In the North\ what beam's may be added by lights pro=  
 jected upon y<sup>e</sup> air from Mountaines of snow  
 or Ice upon y<sup>e</sup> sea's, to make those striae,<sup>130</sup> I  
 cannot say; Nor Considering that y<sup>e</sup> Suns  
 light thro the vaporous air shining long (as  
 there /it\ may happen) on y<sup>e</sup> underside of the  
 levell Courses of the clouds, and those ruffled  
 perhapps with winds aloft /, How farr\ It May appear  
 as If the whole Welkin were In flames. but  
 all this is Nothing to what wee had, ffor /neither\ the  
 suns /nor y<sup>e</sup> moons\ light had any Concerne in it, unless  
 it  
 were to Make it less discernable, ffor the whole  
 generated & /at one time or other\ was Nascent in most  
 parts of the  
 skies round about us, & had No adscititious  
 light, but all Moved from a luminous prin=  
 ciple In y<sup>e</sup> Matter it self; And If wee had had  
 a view of y<sup>e</sup> whole /objects\ open & denuded of y<sup>e</sup> Misty  
 cloud y<sup>t</sup> In great measure offuscated it /them\  
 considering how terrible under that disad=  
 vantage it did appear, It Must Needs have  
 bin one of y<sup>e</sup> Most prodigious sights y<sup>t</sup> Ever  
 was Seen In y<sup>e</sup> heaven's of so long Continu=  
 ance Since y<sup>e</sup> world began, and would have  
 made some think More Seriously of Judg=  
 ment, then they p<sup>t</sup>ended to doe. It is hard  
 to say that y<sup>e</sup> like was never /before\ seen, for  
 who

---

<sup>130</sup> i.e., the columnar, or pleated, forms of the lights

who can Make good a Negative thro  
 all ages, & places? but one may say that  
 there is Not at least /not\ (In My observation /knowledg\  
 at least)  
 any account of the like /Like what I saw\; And If wee may  
 Suppose that such sights have bin seen,  
 (for Nothing under y<sup>e</sup> Sun is New) wee  
 may also Suppose that the old stories<sup>131</sup>  
 about In historicall Relation's, may have  
 bin occasioned thereby; ffor y<sup>e</sup> vulgar are  
 very apt upon any Extraordinary appea=  
 rances In y<sup>e</sup> air, to forme In their Imagina=  
 tion's such shapes, & Report them; and possi=  
 bly this may be in like Manner Represen=  
 ted /downe\ to posterity.

12. But a so  
 lemne war=  
 ning from  
 heaven.

I cannot part without a word or two on  
 acc<sup>o</sup> of thos who by lectures discourses, adver=  
 tism<sup>ts</sup>. &c. goe about to disable /Enervate obviate\ the  
 Religi=  
 ous /& moral Effects applications\ Consequenees of this  
 very Extraordinary  
 Spectacle; by Exaggerating how Comon a  
 thing it is in y<sup>e</sup> North, and that it is No=  
 thing but y<sup>e</sup> Effect of Naturall Causes, and  
 that divers great filosofers have wrote of it.  
 All w<sup>ch</sup> is as Much as /(By way of Harangue --)\ to say,  
 Gentlemen &  
 ladyes, you May goe on In y<sup>e</sup> Sinns, as I doe,  
 for this matter is a work of Nature, and Con=  
 cernes you Not /none of us\. All w<sup>ch</sup> dealing /if true\ as  
 hath

bin

---

<sup>131</sup> The word 'stories' written over a scraped out word.

bin Represented to us shews a spirit of de=  
 generous wickedness, /no less extraordinary & wonderfull  
 or rather portentious\ as then the occasion it self  
 is. ffor grant it was Comon In ye North, What is  
 that to us? It is so uncomon /here\ as ~~Never~~ /not yet  
 owned\ to have  
 bin seen here /among us\ by any man living; And have Not  
 great & Emergent token's In ye heavens bin  
 declared Warnings to men Ever since ye world  
 began? But it is ye Effect of Naturall Causes /say they\  
 what then? warnings are allwais providentiall  
 /tho\ ~~but~~ Not /allwais\ Miracular , at least It may Not  
 appear  
 where ye Immediate providence, or Miracle is  
 applied. As the strong East wind brought the  
 locusts, and ye west carried them away; so  
 /would\ might an Egiptian lecturer /would\ say, adding  
 that  
 ye plague of locusts Came & went by natu=  
 rall Means /yt is ye winds but not a word of him yt ruled  
 ye winds sent them\ I must owne that, having consi=  
 dered Nature more then Every one p'tends to  
 have done; I casnot get off that point,  
 that Even ye Comon / (2)\ Cours of Nature is a  
perpetuall / (2)\ Miracle /to me\, whatever / (1)\  
definition  
of Miracle / (1)\ ye scools may /have bin\ pleas-/-ed\ to  
hold forth'  
 and therefore so farr from 'Minishing  
 any of these ~~sort of~~ warnings, as to think  
 them, ~~stranger as they are~~ /More Engaging by their being\  
 advanced In the  
 Comon Cours of Nature /~~weh is~~ ye proper object of our  
 Notice & observation\; Wee have Capacity  
 & ~~permission~~ /encouragemt.\ to Inquire as to ye Quid of  
 Every thing, but as to ye Quomodo<sup>132</sup> Striktly  
 speaking

---

<sup>132</sup> Quid, 'what'; Quomodo, 'how'.

speaking, Wee /may Inquire /(In deed)\ but can find out  
plainely\ ~~knew~~ Nothing; the Rainbow  
it self comon as it is to be seen, and knowne  
to proceed from naturall Causes, was yet de=  
clared to be a signall to the world. It hath bin  
found out that the colours are distinguished  
by ~~Each~~ /the dropps\ falling ~~dropps~~, In positione; and  
that  
Each ~~hath~~ /transmitts a\ proper /& specific\ ray, (as ~~they~~  
/Geometers\ Call they  
know Not what); all w<sup>ch</sup> at y<sup>e</sup> bottom is as  
much understood by a clown, as by a philo=  
sofer, and both /in\ ~~Equall~~ /equall Ignorance Equally\  
Enjoy the beauty of  
its lustre. No day passeth without Momentos  
Enow If men will pleas to observe & accept  
them; the very faculty's by w<sup>ch</sup> wee are Enabled  
to know Externall things /for ought wee comprehend of the  
means\ ~~are not them selves~~ /(3)\  
more miraculous /wonderfull\, then /(3)\ then Any thing  
without us,  
(how much so ever ag<sup>t</sup> Nature /2\ it /may\ appear to  
be) can be /when Indifferently\ proposed to our  
understandings.  
and the comonest things Carry wonder Enough  
to Excite other thoughts, then our p<sup>r</sup>tenders  
to thinking profess, & they are litle gainers  
by charging Extraordinary appearances  
upon Naturall Causes; ffor the very being  
unusuall is an alarme /w<sup>ch</sup> some\ /~~they~~ are not Easy under  
Especially If y<sup>e</sup> aspects be tremendous\ and whereas Men  
doe Not wonder at y<sup>e</sup> Sun's rising, and  
y<sup>e</sup> appearances of Every Day, yet It is a cer=  
tein effect of /Every pha<sup>n</sup>omenon\ ~~thing~~ Extraordinary &  
admirable,  
to Excite ~~our~~ /a sort of\ passion, & to awake men to  
observe, and Inferre /there=\upon /with Regard\ to  
themselves /& others\  
w<sup>ch</sup> Divines call touching their Consciences, as happens /  
and\ sometimes

But

and /But\ if among fortunes Mignones /there be any\ are  
altogether  
Insensible, and void of Reflex thoughts upon  
Such warnings as this, wee may conclude them  
secure from turning self dangers, tho /an Express\ one  
came  
/to them\ with an advertisement ~~to them~~ /Even\ from the  
[....?]  
But I fear I have run too farr in this tract  
w<sup>ch</sup> you will say is beyond My last; therefore  
I conclude as I am

S<sup>n</sup> y<sup>s</sup>. \_\_\_\_\_

2. Aprill. 1716.

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134r<sup>134</sup>

~~101~~ 1

To Mr \_ \_ \_<sup>135</sup>

Sr

Since you have been pleas'd to think  
y<sup>t</sup> Short account I gave of the late noctur-  
nal illuminations not unfit to be Subjoynd  
to the Weather Gager, being congruous to the  
Subject of y<sup>t</sup> deSign, and withall So extraor

<sup>133</sup> Note that '12' and '11' are the wrong way round; that RN noticed that is indicated in the text by his asterisks.

<sup>134</sup> The BL editor has also re-arranged the essays from a previous order (and from different previous volumes?) so that now the two versions of the Aurora essay follow one another directly. From here on there is a crossed-out numbering starting with ~~101~~, continuing up to ~~108~~ on 141r (this time always on the recto sheet).

<sup>135</sup> According to Friesen (p. 212), this is in the hand of Ambrose Pimlowe, vicar of Rougham between 1710-23.

dinary, that it is doubtfull whether the like was ever Seen before; I have taken the freedom to Set down what I observed a little more carefully, and deliberately, than is pretended in that Paper, wch was done (as I may say) upon y<sup>e</sup> spot, and wth very little Reflection, Such as Men will expect should accompany Observations of that Nature.

Upon Tuesday y<sup>e</sup> 6th of March 1715/6 at near 8 at night I was called out, by a Boy in a great fright, to See y<sup>e</sup> Strangest things y<sup>t</sup> - ever were Seen. I went upon y<sup>e</sup> Summons and found all the family abroad staring about upon the Skie, and as the way of the common people is, full of Alarms, Extasies, and Ejaculations: and Soon after the Minister of y<sup>e</sup> Town

Town came down, having left all his Neighbors assembled about his House, and in the Churchyard, in like amazement, and expecting from him either Interpretations or consolatory Discourses p[ro]per to the occasion: I stood about half an hour with them, and what I saw as well as I can describe, it was as follows.

There was a fixt and a strong Light on y<sup>e</sup> N. and N.E. y<sup>t</sup> Seemd very like break of Day; and from thence (chiefly) diverse streams of Light derived, and spread about every way to y<sup>e</sup> E. S. and S.E. where of the chief Remark eas y<sup>t</sup> these Lights were in perpetual Motion, and change and took diverse ~~Motions~~ forms, Seldome continueing in any one Long, but faster or Slower, ever (as I Said) changing: and So at length wasted. But not only from y<sup>e</sup> N.E. but all over y<sup>e</sup> Skie other Lights emerged here and there, and proceeded to vary till they  
wasted

wasted, and others in like manner Succeeded; Sometimes these Lights began round, and Spreading divided, and Sometimes oblong, like y<sup>e</sup> edge of a thin gilded Cloud in y<sup>e</sup> Sunshine, and these often had a Spice of y<sup>e</sup> Rainbow Colours, these allso divided and dispersd, and I noted, y<sup>t</sup> y<sup>e</sup> parts often took a place as a centre, and from thence radiated round, exactly like y<sup>e</sup> Breakings of y<sup>e</sup> Suns Light in clouds they call Beams: and this Concentration of Beams happend frequently. But y<sup>t</sup> wch was ever most strange was a perpetual fluctuation of Light as it were beyond the mistyness of y<sup>e</sup> Superior Air; wch resembled the h/eaving of great waters: And in like manner I saw many apparent ExploSions of Light, not as tempestuous Lightning darting, but plain kindlings of Gunpowder, or other expolative matter, y<sup>t</sup> went out as it lighted. These happening in order here, there, and there rithmically as I thought, while they lasted appeard very like to platoon-firing These are y<sup>e</sup> chief Phænomena I saw, for not long after 8. I retir'd; It seemd to me

y<sup>t</sup>



that then y<sup>e</sup> Meteor was wasted, but I have been informed, y<sup>t</sup> not only earlier, about 7 but afterwards about 12 and 4 in y<sup>e</sup> Morn the Lights and their Proceeding were; much more considerable, of wch the Spectators may as freely give their account if they So please, as I have here given mine.

The Condition of the skie at this time was, as when thin misty clouds prevail and are very high. Somtimes we might See stars, and then again none and often near y<sup>e</sup> beginning of y<sup>e</sup> Lights there was a Seeming Opacity of cloud as in showry weather, but y<sup>e</sup> Light Soon got y<sup>e</sup> better, and was Seen thro'all. The Lights at 7 as they Said were very red, but when I saw them they were white, and much of y<sup>e</sup> nature of y<sup>t</sup> wch appears in [↔] /thin\ flaxen Clouds when the Sun shines upon them, and they call Mares Tayles. No place was perfectly clear but due W. and a point S. where y<sup>e</sup> Planet Venus shone bright and there remained Some Crepuscular Light of y<sup>e</sup> Sun, but that was too far dipt  
to cast

to cast any Rays towards y<sup>e</sup> N.E. and E. but upon what lay at an immense distance from y<sup>e</sup> Earth, where we Suppose no clouds come.

Now S<sup>r</sup> to give a just physSicall account of this Phænomenon, I think is impoSSible to be done by any one, for y<sup>e</sup> Seat of it is certainly beyond y<sup>e</sup> reach of all our knowledge and Experiments. Therefore those y<sup>t</sup> pretend to it, whatever price they Set upon their Skill, are no better than Mountebanks, y<sup>t</sup> talk of Cures, and Nostrums: for what is y<sup>e</sup> jargon about Sulfur, Nitre, Vapour &c. and Such like confused Idea's of imaginary Agents, y<sup>t</sup> afford not y<sup>e</sup> least explicable practise of any thing but as very aCant as y<sup>e</sup> other? And So also [...] <sup>136</sup> from chimerick Arguments\, y<sup>e</sup> pronouncing at a venture, what this had turned to, in a more Southern clime, is a dream of y<sup>e</sup> Same species. But in regard Physiology scarce pretends to explicate any thing, out of y<sup>e</sup> reach of Experiment directly; but yet improves Experiments by carrying on /y<sup>e</sup>\ Ideas of their Consequences into matters y<sup>t</sup> are not otherwise Comprehensible. The chief fruit of wch is, the distinguishing between y<sup>e</sup> truth of things as they really are, from vain Opinions  
built

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<sup>136</sup> 'ye', washed out.

built upon vulgar observation, or more vain puzzles in y<sup>e</sup> frothy Language of Some Virtuosi. I shall attempt as well as I can to bring this very strange appearance nearer our view and if it may be render y<sup>e</sup> parts of it a little more familiar to our Understanding; [...?] w<sup>t</sup>ever Some may think, I shall not Supplant the due use y<sup>t</sup> is to be made of this Subject wth Religious and Moral Respects, as I hope to evince before I have done.

In the first Place these Lights were very conspicuous, [bei?] as y<sup>e</sup> Aspects of y<sup>e</sup> - great Planets then were. the night was very dark; it may be in a moon light night very little of them had been Seen; for in the absence of y<sup>e</sup> moon, the force of an ordinary moon light was y<sup>e</sup> most y<sup>t</sup> flowed from them. therefore we must range them with y<sup>e</sup> most ordinary Coruscations Seen in dark nights, to which for y<sup>e</sup> variety of them, divers names have been given. The most common of them are w<sup>t</sup> they call falling starrs, and (perhaps y<sup>e</sup> Same thing) night Coruscations, wch are called Lightning; but all these are very different from tempetuuous Eruptions and Fires, for those carry manifest violence, but these none. There is - among y<sup>e</sup> Naturalists a distinction between fire Culinary, and Lambent, which distinction aptly agrees with them. It is certain.

certain there is a lambent fire y<sup>t</sup> appears about Some Animals and Corruptions, and about the Rigging of ships after a Storm, wch the Rom. Cath. Sailors call S. Elmo, and y<sup>e</sup> Antients Castor and Pollux, and is luminous but not penetrant; it is not therfore strange y<sup>t</sup> in y<sup>e</sup> Air wch, more or leSs includes all manner of Substances terrestrial upon other exigencies, in a calm time more should appear to our view, Such innocuous and Silent Coruscations; for as Slight Cauldrons of one kind gather, So another Sort may accend them; for So Spirits of incompatible natures allways tend to doe, and most eminently from Mixtures, of Acid, and Alkali. There is therfore no wonder y<sup>t</sup> various non-tempestuous Lights appear in calm and clear Nights, in those shapes and manners I have hinted, in greater and leSs Phenomena not usually Seen; but after I have Said there is Such a Distinction of fire Lambent, and penetrant, I have said all the Subject will bear, for there is no Such thing as an Explication (clearly) to be given of either, nor is it here material to attempt it; So I hastten to the Case of y<sup>e</sup> present Illumination.

I take this to have been a Collation of y<sup>e</sup> Materials of Lambent fire intermixt

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<sup>137</sup> 137r-138v are a single sheet, folded in half.

mixt with Such Ingredients as are apt to take and administer accension promiscuously; that towards y<sup>e</sup> Poles, or very Northern parts were y<sup>e</sup> head Quarters, where either the frequency of y<sup>e</sup> Coruscations, or the position of them in a Prepective view, y<sup>t</sup> always terminates distance in the Horizon, there Seemd an Aurora Set tled there; and when y<sup>e</sup> Coruscations disperst about and over our heads they were of y<sup>e</sup> same Nature, but in Such positions distinguishable.

As to y<sup>e</sup> Cause of y<sup>e</sup> gathering Such materials, it is ascribd to an access of Northern Air, and bordred below wth one a milder from W. or S.W. fo So y<sup>e</sup> State of y<sup>e</sup> Mercury and Air abroad declard; the GlaSs was very high and had been So for Some time, and hath continued So (only with a little stooping and Reco vering agst Some Slight Paines we have had ever Since) and it was not long before y<sup>e</sup> N. Winds were made below, but at y<sup>e</sup> time when the Illumination was, y<sup>e</sup> wind below was W. and very warm and temperate; therefore y<sup>e</sup> Northerly Air, a constant attendant of high Mercury Kept aloft and came not low, and how high y<sup>t</sup> was is next to be considered. And if we may Judge by y<sup>e</sup> Lights themselves, wch were higher than ever were presumed to be y<sup>e</sup>

Atmosphere

Atmosphere/ical\ altitude: for Common clouds and Tempests are So low, as to make no appearance at 10 miles distance, in plain Countries; theSe Lights were Seen all over England, and phaps a great way farther at y<sup>e</sup> Same time, and in y<sup>e</sup> Same manner, as Acc'ts I have had from London, Maidestone, and Sturbridge in Worcester Shire declare. And y<sup>e</sup> Stamen of these Lights growing in y<sup>e</sup> Air at y<sup>t</sup> height, there was no possibility of Tempest, or indeed clouds, bec' the air is So rare, Such humid Meteors can not gather, as are generated among y<sup>e</sup> fresh vapours or moister air greatly compresst near y<sup>e</sup> Earth; but y<sup>e</sup> Material where y<sup>e</sup> disorder was, being such as we account Spirituous, could appear to us in no other form but y<sup>t</sup> of Light always visible out of great DarkneSs.

The Lights were of two Sorts Motive and fixt, y<sup>e</sup> Motive Seemd attended wth Some DarkneSs as was observd; the faint misty cloudy neSs in y<sup>e</sup> Air was very high also, and Some fishes, or foramina there might Shew strong Light: In wch Reflection, and Somewhat of Refracted had a share as in y<sup>e</sup> Halo, or Parheli on kind, wch gave y<sup>e</sup> Colours, and this Light was from numberless Explosions above, w<sup>o</sup>f this mystery interposition gave us Such forms. The Un.

dæ

dæ, or the Udulæ, or vast wavings of y<sup>e</sup>  
 Light, as Cloath in y<sup>e</sup> Wind, or y<sup>e</sup> heaving of waters  
 might be from very great Explosions, at vast dis  
 tance, wch appearing and vanishing alternately  
 and affected in y<sup>e</sup> paSSage, by y<sup>e</sup> Mystiness of y<sup>e</sup> air  
 above, wch was manifestly unquiet, could not  
 well exhibit to our Sight any Idea much dif  
 ferent from y<sup>e</sup> waving. I am confirmd in  
 this by those Platoon explosions I mentiond  
 wch were most distinguishably Seen, but yet  
 as it were beyond y<sup>e</sup> MystineSSs, for those being  
 Lower were distinguishd as y<sup>e</sup> Body of a Comet,  
 but if Supposed to be removd to a vast distance  
 higher, might not shew y<sup>e</sup> very Source or head,  
 but only the Undæ of them. Now y<sup>e</sup> Lights y<sup>t</sup>  
 were Seen in y<sup>e</sup> Centre of Radiations, as y<sup>e</sup>  
 Sun wth Beams darting every way, I look  
 upon them to have been as it were (to use  
 y<sup>e</sup> word) clouds of Coruscations at an immense  
 height, of wch y<sup>e</sup> Radiations, or at least y<sup>t</sup> share  
 of them coming thro' y<sup>e</sup> broken mystiness, not  
 much otherwise than of Parallel Lines, wch by  
 common perspective Rule, must in Plano ap  
 pear, as a Centre and Rays, the Rather bec'  
 y<sup>e</sup> Rays grew broader as they went from  
 their Centre; ~~for those carry very different  
 from tempestuous Eruptions and fires, carry  
 manifest violence, but these none. There is~~  
 for that among

~~among y<sup>e</sup> Naturalists a distinction fire~~  
for y<sup>t</sup> demonstrates the approach of them.

This S<sup>r</sup> is the Account, I have thought  
fit to trouble you with, of an Illumination, wch  
was a general Amazemt. tho much Slighted by  
Some who have Said it is not only a vain Amaze  
ment, but a very common thing in y<sup>e</sup> more Nor  
thern Regions, by y<sup>e</sup> name of Aurora Borea  
lis, ~~in a more oblique sphere~~ wth the Shine and  
Undulæ wch they Say ordinarily attend them.  
I am Sure Aurora Borealis in a more oblique  
Sphere, where at most time of y<sup>e</sup> year Mid [N<sup>ie</sup>]  
night is as our Break of Day, can be no wonder,  
and y<sup>e</sup> Shine or Beams from it, may happen by [⊞]  
means of accidental Light thrown up from -  
Mountains of snow and Ice at Sea, reflected  
from thick Air, of wch we have in our Crepus  
culums some Specimens, and y<sup>e</sup> Undulæ may be  
from unequal and [<space left>] vapour, or from Some  
Coruscations about y<sup>e</sup> Horizon, as to y<sup>e</sup> manner  
not alien from y<sup>t</sup> Seen here: but I must own  
my Conversation and Reading to be So contrac  
ted as wth y<sup>e</sup> want for Librarys to resort to, for  
conSulting, disables me to give any Natural  
History of this Phænomenon, but I Suppose  
y<sup>e</sup> Virtuosi, if not from y<sup>e</sup> Stage, yet from  
some private Corner of y<sup>e</sup> Experimenting Nation



will give us a full Account of y<sup>e</sup> matter, and till then, notwithstanding our News Letters, and no leSs idle Discourses, I must look upon this as a thing extraordinary rare, and phaps never Seen So fully and generally all over any one Country or Kgdom before. And y<sup>t</sup> wch most pswades me/One\ to think there has been the like, is y<sup>e</sup> many accounts to be found in historical writers of Battels and y<sup>e</sup> like Seen in y<sup>e</sup> Air; for if they had expreSst it to have been in y<sup>e</sup> dark night as this was; it is obvious how y<sup>e</sup> Vulgar in a Surprize will construe Such matters, as they do Lyons &c. in y<sup>e</sup> clouds, and Some no leSs fondly have construed this, and perhaps Some Histories may take it so from us, as we have done from others.

Now S<sup>r</sup> altho' I doe not rank this \_ among prodigies, wch are Supposed to be preternatural, or in Some degree Mira; but y<sup>e</sup> effect of natural CauSes; yet I must affirm it to be matter of great warning or if you please Omen, of no good Consequences to those, for whose Sake poSsibly it comes: in case they shall slight warnings like those, as without dispute have been Sent or allowd to foretell the utter Ruin of Atheistical, Disprincipled and Pervers Nations, and pti  
 cula[rly?]

particularly that of y<sup>e</sup> Jews.<sup>138</sup> As to that whole matter my Sentiment is, y<sup>t</sup> no Day passeth wth out Memento's enough, to dispose Men to reflect, if any Serious Reflection belongs to them, the very faculties and means by wch we are enabled to observe external things, are no Less amazing than the things themselves observed are, and Sufficient to excite other-thoughts than our Pretenders to thinking ~~pr~~ /pro\[pre?\]fs. And they are no gainers by charging extraordinary Appearances upon Natural Causes, for y<sup>e</sup> very being unusual is an - alarm to such as have no Sense of the mysteriousness of y<sup>e</sup> Common objects of sense. I must confess y<sup>t</sup> having considered Nature more closely then generally Men doe, I cannot get over y<sup>t</sup> Point, that y<sup>e</sup> Common Course of Nature is a perpetual Miracle; for how ever we have y<sup>e</sup> Capacity, I may call it Leave to know the *Quid*<sup>139</sup> of many things about us yet the *Quomodo* of every thing strictly taken is irrecoverably conceald from us. And y<sup>e</sup> Rainbow itself, common as it is, and known to proceed from natural Causes, was allowd to be a Signal to the world: the Colours wch have been distinguishd, by assigning to each

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<sup>138</sup> Not, I think, that the Jews are, or were then, thought particularly atheistical and 'disprincipled', but rather that the Old Testament has a succession of very well known portents with prophecies of retribution for the Jews (the Old Testament was after all the book which invented the angry God who speaks in portents through miracles and mundane events alike interpreted by his prophets).

<sup>139</sup> As in the transcription of the essay on Reason in 32526, f. 120r ff, we find the employment of emphasis by means of italicised (and here enlarged) lettering.

each falling drop (in position) a Ray (as  
 they call it they know not what) is at the  
 bottom as much understood by a Clown as  
 by the Artist, but both wonder, and also  
 pceive a pleasing influence at the view  
 of it. There are very few not struck  
 wth a Terror at the Sense of Thunder  
 and Lightning: and I may instance in  
 every occurance of Life So full of  
 wonder to us, as ought wthout more, to  
 be a full warning, not to think high  
 ly of ourselves, and meanly of what  
 is above us, and as far from being  
 known intrinsically in any degree as  
 it is to travel to Jupiter. So little  
 ReaSon is there, as the mode is to ar  
 rogate y<sup>e</sup> knowledge of all things, or  
 wch is all one, to exclude from all ES  
 Sence what we neither do, nor can know.  
 But to leave Vulgar Incidents, wch as  
 I Said carry Warning enough to those  
 that conSider things; what is to be Said  
 of Incidents, y<sup>t</sup> rarely happen, or it may  
 be (like this moving Light) never Seen  
 before. Let them be as much Natures  
 Product as the Rest; Surely they cannot  
 but

but carry So much more of warning as y<sup>e</sup> view of them is extraordinary, or rare. A quotidian notice of Effects may well be no Surprize to common Men, but y<sup>e</sup> others must be So to all; otherwise it may well be Said, that one from y<sup>e</sup> dead,<sup>140</sup> would have as little Influence, and whoever thinks that an hard, as it is verified to be a just and true Sentence; Let him in his imagination, Set upright afore him one of y<sup>e</sup> worlds favourites, and ask himself if Such a MeSsenger would Metamorphose him into a Self Denyer. It Seems Willfull and Impertune folks are allowd by Providence to deceive themselves; and Such Severe Conclusions as are recommended here, to be raised from natural Effects, at least extraordinary Ones, one as easily eluded by them, as the Scripture Miracles are by y<sup>e</sup> great Master in Holland, who hath drudged So much in the Cause, as hath made him and his virtues famous. But least you Say I come too near invading y<sup>r</sup> Province, wch I am Sure is beyond my Last. I add only that I am  
yours &c.

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<sup>140</sup> At this point RN (and/or AP) gets very obscure. For the present I am comfortable reading 'one from the dead' as Christ (or the evidences of true religion, or standards of a just politics), the 'world's favourite' as Newton (or any other manifestation of Whig ascendancy, including the new monarch and his ministers) and 'the Master in Holland' as John Locke (... or any other religious sceptic of a different kind of scepticism from RN).



Nothing hath made more adoe among ye vertuosi then the late appearances, they Aurora Boreales, for a Considerable time no transaction came out without accounts from observers, and so nice and particular as past all Capacity from ye descriptions what it was. I had the fortune to See /one of\ ye most considerable  
 and If I should goe about to describe it as others have done I should think my account Not a litel Impertinent My observation In generall was that the Great luminary lay on that side that is about the North And the Night was Hazie, at a time When ye air Grows humid & full of the Inceptives of clouds, such as were slight and mostly transparent. that the light was stedly near ye Horizon was Remarkable, and the alterations were No other then I could conceiv happened by ye waving to & fro of ye humidity in the air by some slight winds, and all this being high in ye air (as the thinness of ye clouds argued)  
 a Crepuscular light was derived from ye Sun and the Refractions upon this humid air, w<sup>ch</sup> was in continuall change, and Sometime's shewed dark and then opened light all w<sup>ch</sup> seemed to me not wonderfull at all. there was onely twoo things

w<sup>ch</sup>

I took Notice of, and Cannot satisfie my self in ye reason of them

One was a Shaking of ye whole skie in half about ye time of 2<sup>ds</sup> these discontinued and came on Divers times. the other was small luminous Circles neer ye zenith, with Rays Spreading about, and widened at ye Ends, w<sup>ch</sup> lookt /seemed\ as when one looks throo a strait trunk or tube these departed and rose on other And If any one can tell me ye Cause of these Erit mihi Non pusillus Appollo.<sup>142</sup>

As for the comon cant about vapours allwais used in these Meterrall Cases, I have allwais declined it, for ye air is watery Enough to yeild small dropps such as are the beginners of mist and Clouds whenever contraiety of air cold and warme Joyn Never failing to produce them

<sup>141</sup> This page has been folded exactly in half and the text runs in two vertical columns. It is a piece of re-used or scrap paper - see following page.

<sup>142</sup> i.e., 'For me, Apollo is not too weak', i.e. (as I translate this), RN believes the sun (Apollo) to be the ultimate cause of the lights.

And for the Eas of my said trustees and conveniency of my said younger children I doe hereby appoint that they shall choos and Nominate from time to time Some person as In their judgm<sup>ts</sup> shall be fitt and able to manage my said trusted Reall Estate, and by Wrighting Signed with their hands and Names Authorise such person to be Nominated as aforesaid, to Manage, Receiv. Repair, Reckon, set Lett, account and allow, of for and concerning y<sup>e</sup> p<sup>r</sup>miss<sup>es</sup> as shall from time to time be needfull and Expedient for the Making y<sup>e</sup> best yearly proffits /there\of ~~the p<sup>r</sup>misses~~ The said Receiver and Manager to account with my Said Yonger<sup>143</sup>

<red BM stamp>

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<sup>143</sup> This written in RN's most careful hand. It is sideways on to the previous page (thus the length of the lines), in the present binding, reading out from the gutter.

The diseases Called y<sup>e</sup> Gout hath bin stiled ludibrium medicorum; light may as truly be Styled ludibrium phisicorum.<sup>145</sup> ffor Neither ancient nor moderne philosophers have bin able to give a reasonable acc<sup>o</sup> of So Comon a phainomenon. Cartesius thought to make use, of the ordinary recess of body's from y<sup>e</sup> Center of their movement, (w<sup>ch</sup> he calls Conatus ad Motum, for solving of light,) but It will Not succeed. the old Epicurean fancy,<sup>146</sup> of thin shapes, flying continually from y<sup>e</sup> Surfaces of body's, is a Miserable shift, and hath Not /here\ bin taken Notice of, but because it is obnoxious to y<sup>e</sup> Same objection's & Implies rather /y<sup>e</sup> same\ Contradiction's as M<sup>r</sup> Newton's Concepts<sup>147</sup> /are exposed too\ (now the last produc't) /therefore\ I put both together, and direct my discours towards y<sup>e</sup> latter, w<sup>ch</sup> ffor defect & Monstrousness, is a match ffor any other attempt that hath yet appeared, for y<sup>e</sup> Solving of light.

I doe Not here Intend to depreciate, any of M<sup>r</sup> Newton's Experiments, or Mathematicall conclusion's, but owne them Extraordinary, and wonderfully Conducing to Greater discovery's as time may produce. but So Much of the phisicall part of y<sup>e</sup> Subject, as he hath touched, is the Subject of My offence.

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<sup>144</sup> In pencil, top centre-right, C encircled. This may indicate that this was originally a front page to a packet of papers, an assumption supported by the oxidised/worn margin down the RHS and across the bottom of the sheet, indicating a page partly covered by another sheet folded around it. RN's original numbering is crossed out on most of the recto pages of this essay which runs to 168v.

<sup>145</sup> *ludibrium* means 'shame', or 'reproach' - thus, the shame of doctors, and of physicists.

<sup>146</sup> This is the idea that visual perception was by the reception of 'eidola' or 'species' (the appearance of things coming to the eye). There were several competing theories inherited from classical authorities. Democritus and Epicurus had proposed the intromission of eidola, Plato proposed the extramission of optical fire.

<sup>147</sup> Isaac Newton had proposed that light was corpuscular. He argued that small particles travelled through space, passing through transparent objects and reflecting off opaque objects; vision was the reception of these corpuscles by the eye. RN argued that light is the operation of a force on a medium (e.g., ether), thus light is transmitted through a medium as a kind of movement, reaching the eye as a perceived vibration.



1. He supposeth Ray's of light to be pure body, w<sup>ch</sup> moves from y<sup>e</sup> luminary In strait lines, with Inconceivable Swiftness. And these ray's, or bodily Emanations, to have certein property's, as different Measure of Refrangibility, and certein power of Creating In our Sensation y<sup>e</sup> Ideas's of various Colours. And In one place he say's It is Comon for light to become body, and body light; And More to like porpose.

It is very Strang an Exquisite geometer, should ~~se~~ ~~touch~~ /Harp\ upon an hypothesis, ag<sup>t</sup> w<sup>ch</sup>. demonstration after the strickest way, is Engaged. W<sup>ch</sup> /And that\ depend's on this single principle, Body is Impenetrable. It had bin More reasonable to have owned directly that, Body is Not universally Impenetrable, but In some Instances, may be /by other bodys\ penetrated, ~~by other body's~~, & those by other's, ad Infinitum, as In this case of light. But this had been over bold, as tending to Supplant all certeinty of thing's. ffor if Quantum<sup>148</sup> once fail us, it is hard to find another certeinty In its room, I mean of Naturall things, or Sensiti[ve?] as Suppose a space or body of Extent as wee acc<sup>o</sup> a Cubick foot. Quere,<sup>149</sup> Whither this be one body, or more? If More, how Many? & of those what are the Quality's? are all Equally attractive of Each other? (that is another of M<sup>r</sup> Newton's principles) or are they all blew, red, Green, or mixt? by w<sup>ch</sup> wee  
mean

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<sup>148</sup> i.e., 'how much'

<sup>149</sup> i.e., 'question, query'

Mean, body's that falling upon our Retina  
 In y<sup>e</sup> Eye, Make a sence of those Colours. So ffor  
 tasts, perhaps, & divers other Quality's, as /w<sup>ch</sup>\ may  
 be assigned them, as well as attraction and Colour=  
 making, as libitum. or how is this penetrable  
 disposition limited? It is certein that all doe Not  
 penetrate all, Els y<sup>e</sup> world might all shrink up Into  
 any particle. and prison's for Malefactors would  
 be In vain. or are body's Sometimes penetrable, as  
 when taking y<sup>e</sup> Shape of light, they Shall run thro  
 one other, but In gross shapes Not? All w<sup>ch</sup>, with  
 many other like Inquiry's, would Compose a Won=  
 derfull sceme of New Philosofy. Now however M<sup>r</sup>  
 Newton allow's hardness, as y<sup>e</sup> onely thing that is  
 Constant, & wee can be sure of. and Speaks Much  
 of the rarity, & density of body's, admitting the for=  
 mer to Expedite y<sup>e</sup> transmission of light. So that one  
 cannot collect clearly Whither this penetrability be  
 allow'd by him, or Not; but it is Most certein that  
 according to his Notion, it must be allow'd, or he  
 is Egregiously Contradictive; and Whither so, or y<sup>e</sup>  
 other way is most contradictory to Nature, Index  
 Esto.<sup>150</sup>

If there /were\ but one luminous point in y<sup>e</sup> world, and No  
 Reflected light, but all by way of Emanation, or  
 Ray's from that point (allow it able to Supply)  
 and according to M<sup>r</sup>. Newton, a vacuum In the  
 vast

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<sup>150</sup> i.e., 'be it shown'

vast Spaces about it, one May Imagin Corporeall ray's, to Extend by Strait lines Every way. so that Eyes wherever planted. Might happen of a ray or two to discern by. yet Even this hath its Impossibility's ffor how can a point Supply so vast a space. If y<sup>e</sup> Ray's are contiguous neer it, they must at distance open, and so as y<sup>e</sup> light shall Not be Seen In the Intervalls. And If you come neerer y<sup>e</sup> point, y<sup>e</sup> ray's, that at any distance touched, must penetrate; or how is it possible, that light should fill a space, & be admitted into a point, & all the While be corporeall, without penetration?

You will say, the luminary is Not a point but an Extended space of Body, as y<sup>e</sup> Globe of y<sup>e</sup> Sun. then I say it is Impossible, that Extent should be visible. for If y<sup>e</sup> Ray's from one half fill the space, what room is there left for y<sup>e</sup> ray's of y<sup>e</sup> other half. but let that pass. be. S. the Sun <diagram> and D. & E. 2. spectators. D. sees the Quantity A.B. by y<sup>e</sup> Ray's. A.D. [&] B.D /and C. sees it by y<sup>e</sup> Rays E.A. & E.B.\. It is impossible but in the triang. A.C.B. the ray's Must penetrate Each other If you say they are so thin as to pass by Each other I ans<sup>w</sup>, then the Space is Not full, as wee know all places Illuminated are, with light, Such as it is. and If the rays are so fine & thin there, they Shall Gape wide at D. & E, & y<sup>e</sup> Eye must move to & fro, a good space to find one.

But

But there is No need of Refining thus In case of y<sup>e</sup> Sun alone; are there Not Infinite crossing's of light by Reflection? how many miriadds of Starr's are Seen toGether, & Even by Moon light. Nay take a candle in a room; Is any point of y<sup>e</sup> Sides Not visible, and that in Every other point of y<sup>e</sup> room, & all besides y<sup>e</sup> Candle it Self, nay any Number of candles more In y<sup>e</sup> Same room, and Glasses in Every point (If Required) to Reflect Every one. If body be Impenetrable, and luminous Rays are body, what an heap of Contradiction is here? It is plaine how y<sup>e</sup> Epicurean Species Straying from y<sup>e</sup> object, fall under the same difficulty's, and therefore may stand aside together. Whence, I conclude, without farther Quarrell, that No hypothesis of light can be true, w<sup>ch</sup> is Not Consistent with y<sup>e</sup> Nature of Body, & may Not be framed on it, as generally it is Now taken, to be Impenetrable. This I note to Justfye saying so much against a Supposable Quality of penetration, that Els might seem Superfluous.

## 2.

Now It is to be considered If any hypothesis of light may be framed on Such a Constitution of y<sup>e</sup> world, as the Modernes generally (Since Cartesianus,) have accepted, that is Intirely ffull of  
Body

Body & that Impenetrable; And If such May be thought of, and Imply's No contradiction, I may be bold to say, it Must be true. ffor such an hypo=thesis may Not be like other's Invented by y<sup>e</sup> heads of philosophical sects, ffor solving Naturall appea=rances, w<sup>ch</sup> as Cartesius says, may be apt, & yet Not true. And this case of light is such, that there can be but one way In Nature, capable of solving it, and If any doth it, and be grounded on Necessary principles, wee may conclude it is the Right; All w<sup>ch</sup> will best appear by the thing it self, when I have proposed it.

In order to that, wee must consider simply, that bo=dys, are in themselves Capable of Infinite directions, or tendency of Motion, without Contradiction or Incon=sistency. as A. struck at. h. & s. at y<sup>e</sup> Same instant /or successive\, <diagram> or with various force, and Manner any sensitive creature, at d. & e. Shall perceiv<sup>e</sup> those Effects. So a body fixed with Respect to y<sup>e</sup> fixt starrs, Shall move along a ship, and that ship be carry'd by a stream or Wind, and y<sup>e</sup> Earth, annually & diurnally move at the Same time, so Infinite other variety's may be Imagined to happen, all w<sup>ch</sup> have a reall effect on that body, w<sup>ch</sup> hath a path, (Respecting y<sup>e</sup> fixt starrs) Composed of them all, w<sup>ch</sup> by due calculates might be described as any other mathematicall proposition.

Then Next consider body's In Compound, those have no passion's but what arrive from y<sup>e</sup> laws of simple movem<sup>t</sup>.

Movement, as may be shewed, where this Matter is discourst, but here I hasten, & so onely touch it. The best Instance to us of a Compound passion of body, is that of comon water, w<sup>ch</sup> is visible & palpable, and what wee gather from observation of that, May justly be applyed to all Compact fluids In y<sup>e</sup> world, Making allowance for different circumstance's. as y<sup>e</sup> Air hath a Spring, ~~but~~ aw, w<sup>ch</sup> is Not found In Comon water, but that hath Gravity, and undulation's, w<sup>ch</sup> are analogous, and accordingly wee conclude from one, to y<sup>e</sup> other. a Spring vibrates, & setles in an Equitension, water undulates, & setles in Equilibrio or level, so pendulum's, & all like cases.

It Must be Remembered that If a fluid be struck y<sup>e</sup> force is dispersed to all parts, and operates to Re=move them, If such their cession will Make way for y<sup>e</sup> force to persevere. w<sup>ch</sup> dispersing of y<sup>e</sup> force, according as wee find demonstrable from y<sup>e</sup> Effects, is caused by y<sup>e</sup> Irregularity of y<sup>e</sup> parts, ffor In very Regular Compositions. as for Instance cubes, In y<sup>e</sup> <diagram> first case of side to side, the stroke at a. would protrude onely the columne. a.b. And In y<sup>e</sup> 2. of side to Joynt,<sup>151</sup> onely a triang a.b.c. & y<sup>e</sup> Rest Not to be Concerned. The like of Globes, But If in Stead of those, the Composition were of figures & Magnitudes Irregular and accidentall, It is otherwise, for y<sup>e</sup> force disperseth  
Every way

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<sup>151</sup> 'Side to side' i.e., patterned like a chessboard, 'side to joint' i.e., pattereded like brickwork.

Every way as the Motive direction of Every Individuall part, taken by it self, leads. the Sume of all w<sup>ch</sup> comes to that, as I sayd, all parts, w<sup>ch</sup> by Moving would make way for y<sup>e</sup> force will Move. the truth of w<sup>ch</sup> axiom theoreme, is Made out In a proper place.

The onely difference that wee know In the Resistance of fluids, is when it is with or without Spring. wee find No spring in water, but being Inclosed to prevent fluxion is hard, & Resists Compression like adamant. but In open air, the tendency to a level when disturbed, assumes y<sup>e</sup> property's of a spring. Now when y<sup>e</sup> air is Struck with any gross body, the Substance of it is Compres't, and with a spring a sort of Comprest wave is Carryed along Every way. Spherically as water waves circularly. And that comprest wave, is to us the caus of sound. what is y<sup>e</sup> Caus of light, Is next to Consider.

Cartesius found a necessity that y<sup>e</sup> Matter of y<sup>e</sup> world rolling about a center, must Recede, thought that Might Caus in us the sence of light. and In a New matter, used a New Expression Conatus ad Motum, ~~that~~ /w<sup>ch</sup>\ is Not apt, but very Exceptionable. wee will Referr the consideration of this to its place, and allow it to be the Caus of Gravity but Not of light. as to y<sup>e</sup> former, ~~as was to~~ If Greater body's have more power to persevere In Motion, In right lines, then smaller; then according to him, the Gross Matter Must Goe from, & y<sup>e</sup> Subtiler be driven.

driven towards y<sup>e</sup> Center. and light may be Resident More in y<sup>e</sup> Subtiler matter, as y<sup>e</sup> sequel will shew, however when that Conatus (admitting y<sup>e</sup> term) produceth a secerning of y<sup>e</sup> Etheriall matter, some to, & some from y<sup>e</sup> Center, ~~that~~ it will Not ans<sup>v</sup> y<sup>e</sup> Question of light, but that will Requires a motion of y<sup>e</sup> whole Etheriall Matter, so wee Must look Elsewhere for it.

Now wee assigne the caus of light, to be a tremulous motion, that is /a motive Effect of\ perpetuall pulses of /Influencing\ y<sup>e</sup> whole body of the fluid continued from the luminary to the Eye; and the like from Every luminary, & Every Reflex light, all w<sup>ch</sup> tremolas /tho peculiar to Each yet\ are Con= served distinct, & No one Confounds another. The consequence of w<sup>ch</sup> thought is. 1. that the Impossibility of solid /corporall\ rays swerving from the luminary thro & thro one & other, and. 2. The vast difficulty found in the Infinite Quantity & crossing of light /are\ Reconciled; And I should be Glad to find it were possible to doe Either, by any other hypothesis.

Before I declare how this action may be, and Most probably is, produced, I shall Explain how farr the nature of fluids allows of it, and that it is No sole= scisme to affirme, the whole fluid between the fixt Starrs (Not to Mention y<sup>e</sup> Sun) and us, hath a tremula, by w<sup>ch</sup> their light is perceived

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<sup>152</sup> There are a number of small patches of what appears to be white paint (or even bird-droppings!) scattered over this page.



I use No other Maxime but this, that the least body striking the Greatest Moves it somewhat as hath bin shewed, in y<sup>e</sup> Rules of Movement. And Consequently, Every force upon an Infinite fluid hath /as to Extension\ an Infinite effect, or as y<sup>e</sup> Mathematicians Say, beyond any assignable distance /but Ever with diminution of force\. This Cannot Sound harder, nor is less demonstrable, then the famous proposition, of Archimedes, datum pendus Cum data potentia<sup>153</sup> &c. tho Many who will allow his demonstration of that, will controvert this.

Wee have No means of Exposing our thoughts of things Inscrutable, but by the mean's & likeness of Such as fall under sence, and are of like Quality. Therefore I choos a body of water, to adumbrate my sentiment of that action y<sup>e</sup> fluid world as gives us y<sup>e</sup> Sence of light. Suppose a comon pool of water Calme, and one with a proper Instrument strikes hard upon y<sup>e</sup> Surface of it; here are 2. Consequences. 1. the waves that Circulatorily Spread Every way from y<sup>e</sup> Stroke, as from a center. That Represents sound. 2. at the Instant of y<sup>e</sup> Stroke or very neer it, the whole Body of the water is affected with y<sup>e</sup> force, and urgeth y<sup>e</sup> Sides /that is y<sup>e</sup> sides are struck by y<sup>e</sup> means of y<sup>e</sup> water\; so that If any /side or\ part were so weake as to yeild, and Impression would there be Made. or, w<sup>ch</sup> is better to apprehend, If an animall were at Remotest distance in y<sup>e</sup> Water, having a sence /sufficiently\ Exquisite, It would perceiv  
the

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<sup>153</sup> i.e., 'the given weight with the given effort', referencing Archimedes' claim to lift the greatest weight with the least effort

be Explicated any other way.

I cannot omitt here one observation of Mr New=  
 tons, w<sup>ch</sup>, in his way of Expression, is that body's work  
 upon Ray's of light at a distance. as the Ray's a.b.  
 <diagram> passing y<sup>e</sup> Corner C. shall bend, as If the  
 corner bore them off. this is Exactly as  
 the property of a Current. ffor If an ob=  
 stacle be in y<sup>e</sup> way of a current It shall bend a=  
 bout it, as If there were somewhat from y<sup>e</sup> obstacle  
 <diagram> w<sup>ch</sup> protruded. the naturall caus of w<sup>ch</sup>  
 is. that the part. f.b. that falls upon y<sup>e</sup>  
 obstacle, at. d. is pent & so moves a  
 litle swifter and bears towards. e. when  
 it may pass. and that bear's upon the rest, and  
 makes the water at c. [streuate?], tho Not Neer the ob=  
 stacle. The application here is, that the Influence or  
 Ray's of an Impuls on a fluid, or the /tremola, w<sup>ch</sup> is acc<sup>o</sup> as but a\ tendency of y<sup>e</sup>  
 fluid to Move /progressively forewards\ Is Qualified just as the parts would  
 actually /so\ move if free. And where a cession is, there  
 y<sup>e</sup> actuall motion /is apparent\ accordingly. This is y<sup>e</sup> Case of light  
 as hath bin Shewed by Mr. Newton. Hence take it for  
 a constant Rule, That the Quality of light, and of  
 actuall corporeall movem<sup>ts</sup>. are y<sup>e</sup> Same, w<sup>ch</sup> constant  
 Experience Shews.

As to body's that are transparent, & [litle?]<sup>155</sup> More, in [as?] /so\  
 and some partly coloured, some very clear, and the  
 universall Reflection of some light from their super=  
 ficies. and Indeed transparency it Self, depend so

much

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<sup>154</sup> Note that four sheets (i.e. 8 pages) are missing here; we are now on p. 15 by RN's numbering. I seems clear that RN has been discussing the movement of the force of light in terms of the hydrostatics of a current.

<sup>155</sup> Ink has been spilled over the page. The worst and heaviest inking is in the LRH corner where the ink has actually corroded the paper, making it fragile enough for some breakage. There is corresponding staining on the verso, made worse by a patch of semi-translucent brown paper which has been attached to hold the page together. The opposite page (i.e., the previous page, 147v) is also stained in places that match the marking of this sheet. This suggests that the pages 11-14 of this essay may have been removed at an early date owing to ink spillage, these remaining less marked pages having since left their mark upon each other.

Much on y<sup>e</sup> Minute forme & texture of y<sup>e</sup> Component  
 parts of some continued body's, and opacity on that  
 of others, that wee cannot venture at a guess of any  
 particular of that sort; It is the greatest foible of y<sup>e</sup>  
 Moderne philosophy, that y<sup>e</sup> professor's, have dogma=  
 tised in thing's of that Nature. onely In generall wee  
 may, with deference to future discoverys, say, that all  
 body's and Mediums that transmitt or convey light  
 In strait lines are of uniforme mixture, that is of  
 Equall or uniforme density. And that ~~the passages~~  
 Continued or Compound /transparent\ body's ~~that are transparent~~  
 have a certain aeconomy of parts, & Interstices, w<sup>ch</sup>  
 suffizeth for the passing freely of that action or In=  
 fluence, that gives y<sup>e</sup> sence of light, and those ~~opae~~  
 opac; the Contrary. but /that\ the [fibres?] of one such body  
 or medium, doe Not Correspond or lye like those of  
 /others having a\ a different density; therefore the light on surfaces  
 of pellucid bodys, is allwais In some Measure Re=  
 flected, & y<sup>e</sup> rest passeth thro, body's of different Spis=  
 sure. all w<sup>ch</sup> wee may Easily conceiv possible, tho  
 wee, I fear, Shall never know critically how. but as  
 to y<sup>e</sup> possibiliy, let us Imagine a tufty thorn bush,  
 or a knot of snare wire, or a [pa?]rcell of Gross  
 [.....?] stones, put into this vessel of water, and  
 [.....?] on y<sup>e</sup> Surface, the Influence or force  
 [.....?] would pass Each of those Compounds &  
 [.....?] y<sup>e</sup> sides, by lines (quasi) strait, as might  
 [.....?] as before, at a vent, by y<sup>e</sup> projection  
 of y<sup>e</sup>

<diagram> of y<sup>e</sup> Water. and yet No one line Exactly strait can pass these Compound body's, but Every Influence or Ray Must be Justled & Rejusteled, some one way and Some another as I have made a sort of Representation in y<sup>e</sup> Margin; But these diversions from y<sup>e</sup> strait, Setting one ag<sup>t</sup> another, make out an Equi-pollent to Strait. Here wee doe not Include y<sup>e</sup> Entrance nor Exit of y<sup>e</sup> Ray's, to be Considered a part, Nor the Impedim<sup>t</sup> the force meets, from some totall, as the sides of y<sup>e</sup> vessell, w<sup>ch</sup> answers to opacity and Some yeild-in-making /giving\ way more or less for y<sup>e</sup> Influence to pass, w<sup>ch</sup> answers to transparency, In all y<sup>e</sup> degrees of it. & of them ~~Elsewhere~~ follows.

However transparent a body May be, It is absolutely Necessary that part of y<sup>e</sup> Influence falling on y<sup>e</sup> Solid part's of the superfiee's, but Not possible any Should In that Manner Reflect from y<sup>e</sup> Interior parts. tho If wee Suppose Irregularity's, as knot's & lumps (tho very Small) In a pellucid, they will be seen by light Reflected, and So such will have a sort of colour; but speaking of transparency In /Generall I\ Mean of Body's of uniforme mixture. & y<sup>e</sup> clearest wee know; The Reason there can be No Such Reflection's from y<sup>e</sup> Interior part's, is that No Ray's Can ffall upon the part's [oburted?] to y<sup>e</sup> light, as Is on y<sup>e</sup> Superficies, for y<sup>e</sup> Inward part's are Covered by y<sup>e</sup> outward & no Ray can come directly at them

Nor

<diagram> nor touch them but laterally, w<sup>ch</sup> throws y<sup>e</sup> Ray's towards their direction, and Not back, as from the superficies, w<sup>ch</sup> is most Intelligible from this figure. Where No Ray Can come at y<sup>e</sup> parts a. & b. directly from y<sup>e</sup> light, but as they are throwne laterally from other parts in passing, so that that point of Each part as Should Reflect the light back, is Not touched. as a ray on y<sup>e</sup> part a May /from b\ Reflect to. c. but it Must fall then upon y<sup>e</sup> point. d. And So as No Ray's touch but at h. they proceed with litle diversion towards. f. This is y<sup>e</sup> Reason that light Meets with Such a shock at y<sup>e</sup> Superficies of an heterogene medium, and after Entranes, So Much as Getts past y<sup>e</sup> superficies, goes on smoothly.

## 4.

The Manner & Reason of Reflection was Shewed In its place, where I did Not More then touch that Sort of Reflection, w<sup>ch</sup> wee Call Refraction, but Now that Is y<sup>e</sup> Subject to be handled. wee Remember that the difference was, when the Ray's fell upon that part of y<sup>e</sup> body as lay most Exposed to them then the Reflection was to contrary regions, but when they fell on y<sup>e</sup> sides, so as to proceed onely a litle diverted or broken In their cours; that was Not Styled Reflection but Refraction, tho both were founded on y<sup>e</sup> same principles & Governed by y<sup>e</sup> Same Rule of angles. This Effect of light takes its forme most apparently to us, upon passing thro different sorts of pellucid body's; upon w<sup>ch</sup> the  
diversion

diversion or refraction of y<sup>e</sup> light from its strait  
 cours is most visible, and other consequences are  
 of it, w<sup>ch</sup> I take to be consequence of disorder, that  
 is colours. The manner and difference of Reflection  
 & Refraction, is Exposed in this sceme.  
 let. A.B. be the surface of a pellucid  
 body, of w<sup>ch</sup> I Express onely some parts, but  
 whither Regular or Not Regular y<sup>e</sup> Mix=  
 ture is /supposed\ uniforme, and one sort may o=  
 casion a greater diversion of y<sup>e</sup> Ray  
 Refracted then y<sup>e</sup> other as y<sup>e</sup> Shapes happen. /and y<sup>e</sup> substance is so made up towards ee  
 &c these\ cc &c. &  
 dd, &c. shew Rays of light falling obliq on this surface,  
 whereof cc. &c. must Reflect, and shew y<sup>t</sup> faint light  
 w<sup>ch</sup> Reflect's from y<sup>e</sup> superficies of clear bodys. and by  
 how much y<sup>e</sup> obliquity is Greater, by so Much are  
 the Ray's cc &c. more, and Consequently y<sup>e</sup> Reflected  
 light stronger, till at great obliquity none shall  
 Enter y<sup>e</sup> body, but all Reflect, while at y<sup>e</sup> other  
 Extreame, ray's from y<sup>e</sup> perpendicular, as at gg.  
 Shall Most Enter, & fewer Reflect. All w<sup>ch</sup> is Ma=  
 nifest from the constitution of all apertures be=  
 tween part's of any depth, w<sup>ch</sup> close with Inclined  
 posture & open with one direct, & Needs No further  
 discours.

There it is also Manifest that the Ray's w<sup>ch</sup> at  
 moderate obliquity, fall upon the laterall points  
 h.h. &c. are by the comon law of Reflection, thrown  
 Into y<sup>e</sup> Substance, and then Move strait again  
 being diverted, or Refracted by a Reflection at y<sup>e</sup> Entrance.

now

Now, had y<sup>e</sup> light Not met with such diversion, It had proceeded Strait, towards k. and that occur's at the superficies puts it by towards e. so ang. e.h.k. is y<sup>e</sup> angle of Refraction. It Must be considered that the Compound body that thus Reflect's & Refracts is allwaits Supposed to be an uniform Mixture, therefore the accidents, tho there may be Many ~~accid~~ variety's & deviation's Immp perceptible, yet In the main, are quasi all alike, and In all parts Make y<sup>e</sup> same ang of Refraction; but different Compounds have different angles of Refraction as is well knowne to y<sup>e</sup> Skillfull In optick art. W<sup>ch</sup> Shews that y<sup>e</sup> ang. of Refraction, is owing to the Constitution of y<sup>e</sup> body y<sup>t</sup> Refract's, & Not to the Ray's Refracted. W<sup>ch</sup> I would have Remembered together with M<sup>r</sup>. Newtons Refrangibility of light.

It is a noted rule, that Ray's Entering a pellucid body More dens, Refract toward's y<sup>e</sup> perpendicular, and from y<sup>e</sup> dens to y<sup>e</sup> More rare, the contrary w<sup>ch</sup> is but a Revers't cours of y<sup>e</sup> Ray; for it is Manifest the Same occurs, that at y<sup>e</sup> Entrance of y<sup>e</sup> body A.B. breaks y<sup>e</sup> Cours of the light, from c.h. to h.e. must coming from y<sup>e</sup> body In a contrary Cours, & Meeting with y<sup>e</sup> air at y<sup>e</sup> apertures must be bent from y<sup>e</sup> Cours eh. to h.c. and w<sup>ch</sup> happens to & w<sup>ch</sup> from y<sup>e</sup> perpendicular, depends on the constitution of y<sup>e</sup> Surfaces, perhaps they may be so that, Instead of being thrown by. at hh. they

they shall fall on y<sup>e</sup> other side, w<sup>ch</sup> shall throw  
 them y<sup>e</sup> other way. as be y<sup>e</sup> plain superficies. A.B.  
 <diagram> h. a Reflecting & Refracting part. If  
 It happens the Rays. fall at. h. (as  
 happen's in case of Greater density)  
 the Refraction is to the perpendicular  
 z.x. but If they fall on y<sup>e</sup> other side  
 at. g. then for the Same perpetuall  
 reason, the Refraction is to f. from y<sup>e</sup>  
 perpendicular. therefore it holds for an universall  
 rule that If oneway y<sup>e</sup> Ray's break towards, y<sup>e</sup> other  
 way It is from y<sup>e</sup> perpendicular. as out of Gla air  
 to Glass is towards, from Glass to air, is from it. And  
 That May more /easily\ appear If wee consider this seems  
 <diagram> a.a.c. are y<sup>e</sup> parts of a body More  
 dens. b.b. &c. of one more rare.<sup>156</sup>  
 But it is to No End to Refine ~~upon poss=~~ /with divers\  
 bilitys or probabilitys In this matter be=  
 caus, there is Not /nor\ (seemingly) Ever  
 will be a criterium of it; such is y<sup>e</sup> Minuteness of  
 texture & part's on w<sup>ch</sup> it depends, as condemnes us  
 to a perpetuall /Eternall\ Ignorance of all things that de=  
 pends on them. Nay I cannot Conclude /positively\, whither  
 the Refraction of light is from y<sup>e</sup> surface of y<sup>e</sup>  
 body entered, or left, or both Combined. As If wee  
 Enter ~~from~~ /thro\ a pellucid body Into a vacuum, It  
 is not certain but y<sup>e</sup> Ray's may Refract /as well\, at Leaving  
 one

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<sup>156</sup> The diagram and commentating text are very neatly drawn around and crossed out with hatched lines.



one as at Entering another. for Since the passage is curvilinear & accidentall, at the last parting, y<sup>e</sup> uniforme mixture w<sup>ch</sup> produced In some a right Cours failing, the last deviation ~~Suee~~/proc\ceeds, w<sup>ch</sup> Must be a fracture. and then that is directly counter to the Entry; for If y<sup>e</sup> Ray's Entered from a vacuum, they must Refract, till the uniforme swervings gathered a strait againe. Therefore it May be one way as well as y<sup>e</sup> other, & probably, In pleno,<sup>157</sup> Combined of both; but as others, I shall mention it as from y<sup>e</sup> Entrance.<sup>158</sup>

I shall conclude here, with observing, that our borrowed light from a body of water, will demonstrate to us, the nature of transparency In the severall degrees of it, from Exquisite clearness, to perfect opacity. by exquisite clearness, I mean such as the clearest wee know, but None is perfectly so, because all Reflect some light, w<sup>ch</sup> is Wanting in the transit, and much is lost by falling unluckily upon parts /or points\ that divert too Much; so that light Continually diminisheth. In a dens body; as various thicknesses, and more, or less light transmitted accordingly, demonstrate. so that If wee Could Examine Nicely the texture of parts, & see y<sup>e</sup> light upon Each, as wee doe upon Gross body's, wee Should find a world of Roughness Irregularity & disorder In thing's appearing Now smooth as can be Imagined Now In our vessell, let us suppose divers bodys, or clusters of body's, Immerst & fixt In y<sup>e</sup> water. such as thornes, Great stones, wooll, feathers, and others  
as

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<sup>157</sup> i.e., 'in fullness' - plenitude, as opposed to the condition of a vacuum. RN, following Descartes, imagined space to be filled with a very refined form of matter, ether.

<sup>158</sup> In margin, in tiny script - "opacity yellows".

as May be Conceived, then strike y<sup>e</sup> Surface of the  
 water, and the Influence Shall pass thro some of  
 these cluster's, as thro y<sup>e</sup> Great stones, thornes, &  
 Such like; but Not thro wool & feathers. ffor y<sup>e</sup> Ca=  
 pillary part's Receiv so Much of y<sup>e</sup> Impression or  
 Influence, that It breaks all passage thro, and as  
 to that is like a body with No passages at all. So  
 as It is rather the manner of disposing y<sup>e</sup> parts  
 then the Solidity of them, ffor y<sup>e</sup> feather's shall  
 Stop y<sup>e</sup> Influence more then y<sup>e</sup> Stones. and Such are  
 perfectly opac. And If wee Imagin y<sup>e</sup> Stones, so Mi=  
 nute as sand, the Influence from Such a body as wa=  
 ter is, will Not pass so Small meanders. but be all  
 Reflected as If there were None so the /more\ solid May  
 be opac, as well as the light /fewer? less solid\; a such is Gold & Mercury  
 w<sup>ch</sup> let No light pass, or very litle, & then when driven  
 unconceivably thin. Then it is Not hard to Imagin  
 how y<sup>e</sup> Influence may pass other body's In divers  
 Degrees. Nay one Might affirme; that No place is  
 perfectly dark, but light In some Measure may  
 pass stone walls, as men living without other  
 light may discerne, or at least other animalls  
 of more [vespertitios?] sight, If any be; ffor wee are  
 Not to conclude, tho It be our Comon failing; that  
 If wee perceiv Not, there is Nothing perceivable,  
 It is No add hard Remembrance to the Most un=  
 phisicall gen person's, that coming from More light  
 Into less, it seem's at first perfect darkness. there=  
 fore body's seeming perfectly opac. may transmitt  
 Some light, according to the Nature of their density.

Now becaus a clear body, Reflect's so Much light from y<sup>e</sup> Surface, and So litle is lost with in it, wee have a plaine Reason; that is the part's of the superficies are all open and obverted to y<sup>e</sup> light, & towards y<sup>e</sup> Region of y<sup>e</sup> perpendicular, for y<sup>e</sup> Ray's freely to pass, but within y<sup>e</sup> Superficies, the parts Cover one and other, so that No direct ray can come at any part, so as to be Reflected towards y<sup>e</sup> region of y<sup>e</sup> light, or the perpendicular; but they Must fall laterally, w<sup>ch</sup> with less force diverts them to one & another & so they pass thro, with litle Impediment.

<diagram> consider a ball

sent with a strong

& swift motion

a litle obliq between 2. walls. It is plaine at Every touch it will be diverted, & loos litle force. So light passeth y<sup>e</sup> Meanders of a pellucid body. and tho y<sup>e</sup> path of y<sup>e</sup> body is angular, yet y<sup>e</sup> sume of y<sup>e</sup> direction is strait. that is while it keeps in y<sup>e</sup> Compas of the body, but at parting it cannot Continue strait as from c. the last Inclination of its Movem<sup>t</sup>, proceed[s] to E, w<sup>ch</sup> is a Refraction ~~to~~ /of\ y<sup>e</sup> line A.B.

Now tho it is Not such progressive movem<sup>t</sup>, w<sup>ch</sup> Mak[es] Either light, or its Similitude y<sup>e</sup> Influence in Water striken; yet It is y<sup>e</sup> same thing, for I must Now & Ever observe, that No action motion or tendency of any thing In y<sup>e</sup> world Solid fluid, or what shape soever is taken, but In Sume, the Effect's are such as Quarate with the Simple laws of Motion.

The Next matter to be discours't is, that surprising and wonderfull effect of Refraction's, In Shewing such vivid & orderly Colours. Here I must owne my self at a stand, concluding the caus to depend on unsolvable texture & magnitude as well as shape of the parts compounding body's, w<sup>ch</sup> transmitt light; Audendum tamen.<sup>159</sup> It is more profitable In arts & sciences, to be bold & daring, then to despair. Somewhat of vaine flight, is often discovered, w<sup>ch</sup> Exact discovery often comes short off. Even Errors of some, are hints to others, of truth. So with protestation of Modesty, & that I know what I am about, demanding No ones assent, but onely my owne freedome, Without Confidence or ostentation, I venture Into this speculation.

As to the caus of light (not yet throly dealt) and y<sup>e</sup> Impossibility of all solution's hitherto advanced, I have accounted My Concepts already: As to the phanomenon of Colours, There are but two worth Notice one is of Cartesius, w<sup>ch</sup> hath bin Enough Exploded, y<sup>e</sup> other of M<sup>r</sup>. N. Now Regnant, and I doubdt, as faulty, as any other y<sup>t</sup> hath Gon before. But having bin hinted to y<sup>e</sup> World about 30. years Since In y<sup>e</sup> ph: trans: and Now publisht with y<sup>e</sup> authors last Compiling hand.<sup>160</sup> It is Received with Incomparable greedyness & Content, of the filosoficall vulgar, And If there be any Geniuses raised So Much above y<sup>e</sup> Rest, as to draw his Speculation's In Question, they are private as yet.

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<sup>159</sup> i.e.: 'go for it', 'have courage'. The quote may reference Horace's *Epistles* I, 2.40, or it may reference (as he specifically states in BM Add MSS 32545, downloadable from this site) Quintilian's *Institutione Oratoria*, Book 1, chapter 5, section 72 (who was presumably knowingly quoting Horace, anyway).

<sup>160</sup> This gives us secure internal evidence for dating the MS, the *Opticks* was published in 1704, the paper to the Royal Society had been circulated in 1672.

His thought is that comon light, or White, is Composed of Ray's (as they are Called) as Indistinguishable threads penciled all together, So as y<sup>e</sup> Eye can Make No distinction of them. and that these Ray's have all proper Colours and are to Each other heterogene, as Gold silver lead. &c. Each having distinct propriety's, and particularly to be Refrangible, but Not all to y<sup>e</sup> Same angle, but Some to a greater angle & others to a lesser, according as their Nature Require; and for that reason, when light is Refracted, that w<sup>ch</sup> Was white before, (y<sup>e</sup> Effect of all Colours Mixt) Now is become Sorted into divers colours, upon No other occasion then Meer separation, w<sup>ch</sup> lay's them one by another in such order Gradually, as their Respective Refrangibilitys are More or less.

He Explains (I cannot say proves) this, by Many Elaborate & Exquisite Experiments; all w<sup>ch</sup> May be Reduced to y<sup>e</sup> Effect of a Comon prisme, w<sup>ch</sup> Most know, and have proved; and amounts to No More but that objects seen across y<sup>e</sup> Solid angle of a prisme, shew at all y<sup>e</sup> Edges of them, the Rainbow, Colours. he adds, that No Refraction will alter those Colours, but giving them a 2<sup>d</sup>. prisme, & y<sup>e</sup> Blew will be blew, without alteration. perhaps there might be some rows of y<sup>e</sup> blew alone, at a 2<sup>d</sup>. prisme, distinguisht by fainter & deeper coloured, tho Not by heterogene Colours; but this is left to Experiment. that w<sup>ch</sup> I have to say ag<sup>t</sup> this hypothesis, is

That Refraction doth Not Shew Colours, but In some particular Cases, and Not universally, as it Must doe, If colours appeared by separation from different Refrangibility. And this I demonstrate with this observation That In No case of a single Refracted light, any Colours or glimps of any, appear. Wittness the Comon Experiment of a Sixpence In a bason, or any thing from under water, as a Staff or oar half Immerst, w<sup>ch</sup> are Seen by Refracted light, but without Colour. I cannot Make y<sup>e</sup> argument by Induction of all Instances becaus they are Infinite, but I challeng any one of y<sup>e</sup> Contrary Effect to be Shewed. And then I argue, that If the different Refrangibility Separated y<sup>e</sup> light Into sortment of /Colours\ light It Must happen, upon every Single Instance, and Never doth ~~ha~~ it happen In such. I admitt that upon a double Refraction successive, by w<sup>ch</sup> the Ray's are almost turned Round, colours appear, as thro the 2-sides of a prisme; And Mr. N. gives No Instances but of such. therefore he argues faultily, Inferring an hipothesis universally, w<sup>ch</sup> from some partiall & particular Experiments.

I will goe farther, and Shew, that a double Refraction will Not Colour any thing, If a plaine Reflection Intervenes. for So it is In y<sup>e</sup> Case of a six pence In a bason, for y<sup>e</sup> light is Refracted at Entering the water, then Reflected from y<sup>e</sup> Water /pence\, are Refracted at the air againe. but No Colours. So In a prisme, No Image Reflected from an Interior side, seen thro the side obverted to you /is\ are Coloured, and yet y<sup>e</sup> Rays  
are Refracted

are Refracted at y<sup>e</sup> Side Entering, and at the side going out, onely Reflect at y<sup>e</sup> other side In passing, this shews that y<sup>e</sup> Reason of y<sup>e</sup> Rainbow, or (w<sup>ch</sup> is y<sup>e</sup> Same) y<sup>e</sup> Colours in a dew drop. are Not caused, by the 2. Refraction's & one Relection purely as such; but from other circumstances of y<sup>e</sup> figure of y<sup>e</sup> dropp. ffor the Same happen's Not In a bason of water or prisme, w<sup>ch</sup> hath y<sup>e</sup> same. The onely difference I Can gather is, that In a prisme, the Ray's Refracted, Reflected, & Refracted againe, Run paralell, as to that, undisturbed. but In a drop, the Converging of y<sup>e</sup> light by reason of the sphericall Curve, and diverging againe at y<sup>e</sup> Exit, Hudles & devides it, and May give it a distinction In our sence.

So upon y<sup>e</sup> Whole, all M<sup>r</sup> N.<sup>s</sup> fabrick tumbles, and It were time lost to Enter Into Examination of y<sup>e</sup> Subtlety's of it. particularly, of the colours falling in y<sup>e</sup> devidions of y<sup>e</sup> Monochord, w<sup>ch</sup> give y<sup>e</sup> diatonick tones in an octave. of w<sup>ch</sup> Observation, If it were Most Nicely /so\ I know No use or Inference to any porpose drawne from it. ffor If all y<sup>e</sup> tones of a diatonick octave sounded together as those colours affect y<sup>e</sup> Eye all together, It would be but a Scurvy sound, & No credit to y<sup>e</sup> view to Resemble it And for his thought that light is tremolous, I beleev it certainly so /. but In y<sup>e</sup> manner wee shall differ\ but how far this, and y<sup>e</sup> Rest of /his\ hypo-thesis Is consistent with y<sup>e</sup> Explication of light I have made, or Indeed Nature it self, If wee know any thing I leav to y<sup>e</sup> Judicious to determine.

## 5.

Now to deliver, what wee have to say of Colours,  
I first set downe my notes of their appearance.

1. All colours appear in luminous body's /as well\ originall  
Such as y<sup>e</sup> Sun, fire. &c. as by Reflection, as y<sup>e</sup> Moon  
planets, &c. ffor by art firework's are Made of almost  
any Colour, so Mars & venus are of a different Com=  
plexion. And If comon things that shew colour, had  
force of light Enough, & were seen out of dark, Would  
Shine as luminary's, tinted with y<sup>e</sup> Colour upon them.

2. Divers Colours blended together Make a Confusion  
and that very Confusion hath a tinct wee call some  
colour, as yellow blew mixt, appear Green. W<sup>ch</sup> is  
an Idea of a confusion onely, that by a Microscope  
is discovered, by w<sup>ch</sup> y<sup>e</sup> colours are viewed apart, &  
y<sup>e</sup> Green is vanished.

3. More or less force of light, hath a great share in  
the degree of Colour. as painters use all ~~colours~~ /degrees\  
between black & White, to Express a drapery. So that  
a degree of light proper, is needfull to shew a colour,  
ffor If strengthened it becomes white, & if abased, black.

4. I fear wee have Not a good Naturall history of Colours,  
and particularly those made by Refraction. ffor wee ob=  
serve litle, but In glass or water, w<sup>ch</sup> are as to this  
purpose, much alike; Talk,<sup>161</sup> as M<sup>r</sup> Newton observes,  
is very particular, for it splitts y<sup>e</sup> Ray's, & In Re=  
fraction makes a double appearance; It were well  
to have a prisme made of talk, Amber, Rozin, Horne  
and

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<sup>161</sup> i.e., 'talc' [?]



and ye like, by w<sup>ch</sup> one might observe the differences of Effect upon Refraction's thro divers body's.

5. A single Instance of Refraction shew's No Colour at all. and If there be many Refraction's paralell wise and Reflection's Interpose, so as Not to break that order, no Colours appear, for so Each Refraction is single.

6. Refraction's double, y<sup>t</sup> is one after another, without any Reflection Interposing, If to Contrary parts, give No Colours. as thro a pellucid body with paralell sides, where obliq light Entring refracts to the perpendicular, and going out, from it, & so passeth in a direction (at least paralell,) as before. M<sup>r</sup>. N<sup>s</sup>. reason for this, that the Refraction's Restore one & other, so as what ye first devided ye. 2<sup>d</sup>. Joynes againe. but It will be found that at ye Edges, the mixture is Not Restored but [Gradatius?] at least, so at ye Edges Colours ought to <diagram> appear, but No glimps is to be seen. . as the ray. e.f. is Refracted at f. to g & thence to h: there is Nothing to Mixt mix with that, as perhaps may be at a.b.c.d.

7. When there is a double Refraction the same way colours very vivid & strong are produced, when the proof is In water or Glass, & some other body. the comon experim<sup>t</sup> is by a prisme. as ye point. a thro <diagram> ye prisme b.c. will be seen at d. & very Much coloured, like and in order as In ye Rainebow.

8. In a drop of water; as, dew. the light Entering on one side, and after Refraction, falls on y<sup>e</sup> Interior Surface, & there /great part\ Reflects, & /so\ passing out on y<sup>e</sup> other side, with a 2<sup>d</sup>. Refraction, shews very Strong Colours, and is y<sup>e</sup> caus of y<sup>e</sup> Rainebow, & /of\ y<sup>e</sup> lively Colours seen In dewy Mornings in y<sup>e</sup> drops y<sup>t</sup> sitt on y<sup>e</sup> points of y<sup>e</sup> Grass. I observe that passing by a drop in /y<sup>e</sup> y<sup>e</sup> \ right place a Colour appears /And\, moving /a litle\ Shews another, & so others till None /at all\ are seen; and this space /to be\ moved for taking /view of\ all y<sup>e</sup> Colours is considerable Enough to Shew y<sup>e</sup> Ray's are Not parralell but converge at y<sup>e</sup> drop & open from it. The process of this light <diagram> is as In y<sup>e</sup> sceem. R. the Ray's y<sup>t</sup> fall paralell on one side of y<sup>e</sup> drop  
 A. and Refracting are Contracted a litle at B. and there Reflecting open again somewhat towards H. and Issuing are Refracted wider, & pass to D C. & E. In w<sup>ch</sup> space the colour's are Seen one after another. It seem's here that the 2 Refraction's at H. & G. with y<sup>e</sup> Reflection at B are not properly y<sup>e</sup> caus of the Colours, becaus the like In a prisme produced None. but It is the breaking the paralellisme of y<sup>e</sup> Rays done here, but Not in y<sup>e</sup> prisme, w<sup>ch</sup> is the caus of the Colours. y<sup>e</sup> Manner of w<sup>ch</sup> is as hath bin described, tho perhaps Not Exactly delined.
9. When y<sup>e</sup> object is neer y<sup>e</sup> prisme, No colours appear, tho there is y<sup>e</sup> Same cours of y<sup>e</sup> Ray's as  
 when

when More at distance. as for ~~Instance, why sh<sup>e</sup>~~ /Experiment\ lay a prisme with one angle upon this paper,<sup>162</sup> and you Shall see all y<sup>e</sup> letters Magnified, as In a lens, but No sort of Colour, Nor disposition to it. and Move y<sup>e</sup> prisme from y<sup>e</sup> paper, and at about 6 inches distance y<sup>e</sup> Colours begin to appear, and at last grow very lively about y<sup>e</sup> letters. No acc<sup>o</sup> is given of this by M<sup>r</sup>. N. and it is, for ought I see, a flat confutation of his Refrangibilitys. ffor Why Should Not a Ray /2.\ ~~tw~~ Inches long have y<sup>e</sup> Same Cours of Refraction as one six inches long ~~hath~~? I am sure as to y<sup>e</sup> prisme the length of y<sup>e</sup> Ray is Nothing, for pointing to y<sup>e</sup> Surface, is but as a point.

10. put ones Eye close to y<sup>e</sup> prisme next to touching and it Makes No alteration, but what was Coloured at a distance is so near, w<sup>ch</sup> holds Not on y<sup>e</sup> other Side as was observed.

11. Nothing is Coloured In a prisme but the Edges of objects, and the Colours will cross the prisme, as well as run long ways of it, but that most. And generally y<sup>e</sup> Colour Sitts broad on all the Confines of thing's where the - strength of the light any way alters. the level barrs & ledds of windoes will, holding y<sup>e</sup> prisme level be all coloured, and a rumped paper, shall seem Rumped by degrees of Colour, ffor y<sup>e</sup> lights there will be coloured, according as they are strong, and generally Speaking The Strongest light hath Strongest Colour, Especially When darker is by; And once for all, It is Impossible by a prisme to Colour an uniforme body, but at y<sup>e</sup> edges. Whither all these agree with M.<sup>r</sup> N. I contend Not here.

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<sup>162</sup> Note that we are now reading from a surface experimentated upon.

12. I set my Candle upon my desk aforeme and took my prisme, and found y<sup>e</sup> upper Edg of this paper tinted onely with a blew, w<sup>ch</sup> spread as I drew the Glass further from y<sup>e</sup> paper (as was noted N<sup>o</sup> <space left>) and Moving my Ey from y<sup>e</sup> Glass made litle alteration. I Could Not make y<sup>e</sup> prisme cast any other Colour there, but then I took a Brazil-folding stick & layed upon my paper with y<sup>e</sup> Edg at y<sup>e</sup> upper line, and that Edg was tinted with a strong, orang-yellow; then I would see how these would agree and I moved up my yellow Into my blew, & it gott y<sup>e</sup> better & Stood in its place. this Could Not be after y<sup>e</sup> doctrine of Refrangibilitys. ffor If The Ray's onely blew would be seen from y<sup>t</sup> place, how comes Red /Orang\ to sit In y<sup>e</sup> Same place? Then I layd my folding stick upon my desk with Edg paralell & neer to. y<sup>e</sup> Edg of my paper. The my folding stick was tip't with blew & Not yellow. That is y<sup>e</sup> shade of it, for y<sup>e</sup> Candle Standing behind made it Cast a shade on y<sup>e</sup> desk, w<sup>ch</sup> was /in y<sup>t</sup> posture blew\ ~~orang~~, & not tinted with any other Colour. then I Advanced My paper and layd y<sup>e</sup> lower Edg upon y<sup>e</sup> midle of y<sup>e</sup> folding-stick, and then it was turned orang, and y<sup>e</sup> shade of y<sup>e</sup> Edg of y<sup>e</sup> folding-stick blew. So observing my folding stick upon y<sup>e</sup> paper the upper Edg was blew, & y<sup>e</sup> lower orang. And laying y<sup>e</sup> folding stick neer y<sup>e</sup> upper Edg of y<sup>e</sup> paper, I took y<sup>e</sup> view of it thro y<sup>e</sup> lower angle of y<sup>e</sup> prisme, (y<sup>e</sup> former was y<sup>e</sup> upper angle.) & y<sup>e</sup> Colours were counterchanged y<sup>e</sup> paper was Edged with orang, & y<sup>e</sup> wood with blew and I brought y<sup>e</sup> blew Into y<sup>e</sup> place of y<sup>e</sup> orang, as before.

13. I cannot but observe when I took My paper thro y<sup>e</sup> lower angle of y<sup>e</sup> prisme, the head of it was orang, and the Sides If lay'd at Right angles to the prisme, had no Colour, but If I turned y<sup>e</sup> paper Inclining but a litle, y<sup>e</sup> left Edg took an orang, & y<sup>e</sup> Right a blew, and Inclining y<sup>e</sup> other way y<sup>e</sup> Contrary; and y<sup>e</sup> paper being folded as usuall for orderly wrighting the depressed seams were orang, & y<sup>e</sup> raised Blew; and this w<sup>ch</sup> way soever I Inclined y<sup>e</sup> paper. And when y<sup>e</sup> upper Edg, or y<sup>e</sup> left, was Red, y<sup>e</sup> lower & & y<sup>e</sup> other Edg were Red or orang. And If any Edg was coloured with Red or blew, turne it over a litle, & y<sup>e</sup> other side Shewed contrary wise blew or Red.

14. Every thing is Contraryed between y<sup>e</sup> two angles of a prisme; ffor what is Blew thro y<sup>e</sup> upper, is red thro y<sup>e</sup> lower & contra; and so y<sup>e</sup> upper Magnifies as a len's, but y<sup>e</sup> lower deminisheth. And this by the length, as well as a thwart y<sup>e</sup> prisme. And In fine I Shall againe observe, that all y<sup>e</sup> Colours come according to y<sup>e</sup> Inequality of the light, ffor the least difference of More or less lustrous, makes the prisme shew, Els Nothing appears. And when y<sup>e</sup> Colours come they Spread, as If the air about y<sup>e</sup> part were tinted. And In this manner May be an Endless diversion by observing y<sup>e</sup> Miracles of y<sup>e</sup> prisme. And therefore I have bin too tedious, becaus y<sup>e</sup> Reading of one, is selome so aggreable as wrighting to another

These /latter\ Experiment<sup>s</sup> or rather observations wh<sup>re</sup> where I  
 Speake of orang, were Made by a candle. day light lit=  
 tle alters them, onely Blew hath violet to attend it  
 and y<sup>e</sup> Red or orang hath yellow; But In generall at  
 all lights I observed that, these 2. Shades (to use a  
 terme in Imbroidery,) of Blew's with violet, and Reds  
 with orang & yellow could hardly be brought together  
 unless there were 2. Edges or termination's of y<sup>e</sup> light  
 y<sup>t</sup> Ranged paralell with y<sup>e</sup> axis of y<sup>e</sup> prisme. as at A.B.  
 <diagram> If y<sup>e</sup> Edg A. were In Blew's B, was y<sup>e</sup> yellows  
 & contra. but If y<sup>e</sup> space A.B. were small  
 then the 2. orders of Colours semed to Joyne.  
 ffor flowing over a Small space, as they do y<sup>e</sup>  
 object, such as y<sup>e</sup> transam, or /level\ Ranges of y<sup>e</sup> Shass<sup>163</sup> In a  
 windoe are, is hidd with colour; And seen thro y<sup>e</sup> upper  
 or lower angle of a prisme counterchanges them  
 as before, Whereby I saw plainely, that y<sup>e</sup> Reds were  
 Next y<sup>e</sup> Angle & y<sup>e</sup> blews Next y<sup>e</sup> flat side of y<sup>e</sup> prisme,  
 w<sup>ch</sup> is y<sup>e</sup> reason of y<sup>e</sup> Countercharg I Noted before. And In  
 M<sup>r</sup>. N<sup>s</sup>. Experim<sup>t</sup> of a foramen, at w<sup>ch</sup> light Ente=  
 red upon y<sup>e</sup> prisme, all Els dark, No wonder If the  
 colours came together, In w<sup>ch</sup> he found out y<sup>e</sup> wonderfull  
 proportio of y<sup>e</sup> Musick scale; ffor y<sup>e</sup> top Edg of y<sup>e</sup>  
 hole gave one colour & y<sup>e</sup> bottom another, as y<sup>e</sup>  
 Angle of y<sup>e</sup> prisme lay. If Instead of a foramen, then  
 had bin a perpendicular Slitt he would have found  
 y<sup>e</sup> Colours devide, y<sup>e</sup> Reds one way & y<sup>e</sup> blews another.

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<sup>163</sup> An early use of a familiar word, idiosyncratically spelt as 'Shass', later conventionally spelt 'sash', recently introduced from the french 'chassis' (meaning frame, as in window frame).

As to y<sup>e</sup> Colours, It is My thought, that they are onely a graduation or shade from darker, to lighter. And the life and beauty of them depends on y<sup>e</sup> force of y<sup>e</sup> light, ffor ag<sup>t</sup> a window or luminary, they will be Exquisite, and from y<sup>e</sup> heightened shining of Mettall y<sup>e</sup> Same, or rather more Glorious becaus of y<sup>e</sup> Darks adjoyning. for it is with these Colours, as with light it self, clarior in tenebris,<sup>164</sup> for Reason Notorious. But this shade Comes from disturbance y<sup>e</sup> light hath In passing from y<sup>e</sup> prisme to y<sup>e</sup> air, proceeding ffrom that w<sup>ch</sup> happened at y<sup>e</sup> Entry. ffor Neither in Nor out Makes any Colour. If y<sup>e</sup> Ray's are Reflected within as was Noted. But It Must be observed that the Glass Continually thicken's from y<sup>e</sup> angle to the side. and wee may well allow the Influence w<sup>ch</sup> hath past the less part of y<sup>e</sup> body to Issue with more force then the other. And When y<sup>e</sup> light is uniforme, as If you look at y<sup>e</sup> blew Skye an Even white, or any Colour, Not Interrupted or varied, all is a-like, & No colour can stick in one place more then another. the difference that is, may Not be readily perceptible, & proceeds from y<sup>e</sup> augmenting thickness of y<sup>e</sup> mettall; for the thickness of that takes from y<sup>e</sup> transparency.

But If there be any part Not luminous, or any Inequality in y<sup>e</sup> light (w<sup>ch</sup> I affirme is what in a prisme, onely makes Colours appear,) then  
you

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<sup>164</sup> i.e., 'more bright in the darkness'

you have an Interruption, and y<sup>e</sup> Edges Not terminated but shaded as I said with more, & less light, that side y<sup>t</sup> is towards the thinner Mettall is Shaded with y<sup>e</sup> brighter Colours, y<sup>t</sup> is Redds & yellows; y<sup>e</sup> other towards y<sup>e</sup> thicker Mettall w<sup>ch</sup> gives more Impedim<sup>t</sup> to y<sup>e</sup> light passing, takes y<sup>e</sup> darker Colours, blews, violet's purples. but that they are both Ever in one Continued shade otherwise then from the proper sides brought by designe or accident together. I Deny. And all that I affirme of them, is that they are no other then a shaded transition from darker to lighter, how= Ever they /come to\ produce that Image, wee call blew & Red in us.

It will Not be thought Strang, tho Wee Cannot know how, that the light passing y<sup>e</sup> Mettall and Issuing with a great Refraction, after one at y<sup>e</sup> Entry Should be disturbed, and Scatter; So that the light & shade shall not terminate Each other Exactly as our comon sight shews. But take this familiar Resemblance, (ffor wee cannot adumbrate these Effects of light otherwise then by visible Effects of Greater bodys In Motion.) Stand on an hill, and view a great Cataract of water, falling from and high Mountaine Into a Vale. And you Shall see an Even Colour; So afterwards In the Current,  
But



But In the Joynt between y<sup>e</sup> falling and y<sup>e</sup> running stream, you shall see an Edg of white. This at distance would be a Wonder, & as other dark phenomena, draw Much Conjecture. But draw goe Near, and you Shall see y<sup>e</sup> Water broken & Reverberated So with y<sup>e</sup> fall, that it is turned Into almost froth, & accordingly appear's white, till passing away In a Comon current, it hath y<sup>e</sup> Colour as y<sup>e</sup> other water had. So it happens that the light at y<sup>e</sup> Exit from y<sup>e</sup> prisme Meet's-with /falls Into\ Some order as y<sup>e</sup> Water falling hath, and y<sup>e</sup> dark/-er\ part's of y<sup>e</sup> object, takes of some parts & leav's others swerving a litle about y<sup>e</sup> Confines; w<sup>ch</sup> disorder, defect, & swerving, [~~Exit of?~~] occasion's In us y<sup>e</sup> Sentiment of Colours, And No wonder If different and Ingraded, or as they Say Shaded, as y<sup>e</sup> thickness of y<sup>e</sup> Glass, perpetually alters. So as that w<sup>ch</sup> is /Shaded\ Neerest the dark In /y<sup>e</sup>\ thinner Glass, is Reddish, & Goes off in yellows; so that w<sup>ch</sup> is /Shaded\ Neerest it, on the thick side, is blew, & goes of In violett's, & purple. Here is all wee can pretend to shew, to raise a Conception of a possibility of a variegated appearance In this case, of colours. untill More Minute discovery's are Made. If wee had /under our Examination\ y<sup>e</sup> texture of y<sup>e</sup> part's of a prisme, as wee have of that body w<sup>ch</sup> occasion's our peceiving colours In y<sup>e</sup> Rainbow, that is a Congeries of drops, or Globulets of water, wee Might have a neerer

Guess

Guess as wee have of that, so farr as to Shew  
 how the light passeth in Each single drop, but  
 were wee so well Informed, I cannot say wee  
 Could yet have a more ~~Expliti~~ Explicite know=  
 ledg of ye reason; then wee have Now. ffor wee are  
 as much at a loss, to know ye true Reason of  
 Colours being produced Even In them, as In the  
 prisme it self. And therefore /(as I sayd)\were ye substance In  
 w<sup>ch</sup> ye Rainebow appear's as practicable to handle  
 and turne /as ye prisme is, without knowledg of its composition\ wee should make our  
 observations  
 without Regard to dropps, as wee do Now of ye  
 prisme, without Regard to the /any\ texture of ye parts.  
 And It May be, for ought wee know, that there are  
 Effect's of light In some Minute component parts  
 W<sup>ch</sup> are Sunk too deep in Minuteness, for us Ever  
 to gaine, so that A philosofer, looks on a prisme  
 as a clown doth on ye Rainebow; admiring, &  
 that's all. So Much ffor observations.<sup>165</sup>

## 6.

In these observation's wee gather, that light In  
 passing ~~lum~~ thro diaphanous body's, meets with  
 some alteration of the manner of its Coming to  
 the Eye.<sup>166</sup> and so /wee take\ that ~~is to be~~ /as\ admitted; and yet  
 from thence, ye Colours come to appear; but how  
 ye coloured Images take Such formes In our  
 sense, wee are yet to seek. ffor why is one blew  
 &

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<sup>165</sup> In margin, in a tiny script: [Se?]nce of [Col?]ours

<sup>166</sup> This is the key point. As a Cartesian, North is not interested in producing an ontological account of the phenomena of light, rather an account of how the laws of motion are obeyed (the slowing down of rays and the variation of colour) and how the eye reads that within its own limitations or defects - or rather, how the brain interprets the sensory information deliverd by the eye. He is not, therefore, like Newton, interested in establishing a law of nature to be observed, explained and offered up for experimental proof. Rather, he sees the philosophical project as one of reiterating the inevitability of doubt and defect, inititally established by a self-reflexive, epistemological realisation of the limitations of the human brain/body (as linked to the world through the senses) for understanding the world.

& y<sup>e</sup> other Redd, or yellow. What Makes the diffe=  
 rence? Cartesius ans<sup>r</sup> to this was, that our Images  
 of colours, ~~ffrom~~ /occasioned by\ such & such Emotions of materiall  
 parts, as affected us with them, was y<sup>e</sup> pure will of God,  
 & No other account Could be given of them. he thought  
 It was Enough, to Shew as many variety's In y<sup>e</sup> Caus  
 as Wee felt in y<sup>e</sup> Effect, & Not vainely Inquire farther.  
 And however there may be much Crittiscising upon  
 accidents from y<sup>e</sup> first Movem'<sup>t</sup> thro all mediums with=  
 in, & without y<sup>e</sup> body, till it /y<sup>e</sup> Image\ comes to the Internall  
 Spirit or Soul, where wee pronounce of it, yet at last  
 There is y<sup>e</sup> criterium; as certain as y<sup>e</sup> Soul hath Essence.  
 It is vain to ask Question's of Essences, as why is  
 this water, why is this stone, or this Earth. philoso=  
 phy aim's at No More then to say what, Not why:  
 but the latter is of consequences, as why is this wa=  
 ter level, stone hard, or Earth fertile? So It May be  
 Sought how it comes, that body's so distant as the  
 sun, and starrs should gives us Reptiles here a Senti=  
 ment of them? wee may p<sup>r</sup>tend to trace y<sup>e</sup> Motion  
 from thence thro y<sup>e</sup> organ, & Nerves and there wee  
 must leav it. for wee cannot say why /such Image as wee call\ blew, then  
 why the headach is such a pain, and y<sup>e</sup> Gout Such  
 another? They are Essences, part of our nature,<sup>167</sup>  
 as wee are Individualls, capable of sensation, thus  
 wee conclude this p<sup>r</sup>sent discours of Refracted Colours  
 leaving y<sup>e</sup> possible variety's In y<sup>e</sup> movem'<sup>t</sup> of y<sup>e</sup> Influence  
 to y<sup>e</sup> power of observation & comparison, and the  
 Images, to the Internall faculty of perceiving, w<sup>ch</sup>  
 perhap's may be treated in another place.

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<sup>167</sup> For RN here, as elsewhere, the business of explanation in natural philosophy includes the explanation of the limits of explanation. He is a radical Foucaultian, sometimes.

## 7.

Having done with the Mechanisme of light, Shewing how a violence falling upon a fluid body, Imparts such a force as may Impress upon an organ of sence Capable of Receiving, as y<sup>e</sup> Eye is, Whereby I configure the action, wherein consists y<sup>e</sup> Caus of light, And dilated Much upon y<sup>e</sup> Case of Refraction, as to y<sup>e</sup> Nature of Colours, passing by the case of Colours by Reflection, w<sup>ch</sup> hath No difficulty y<sup>e</sup> other admitted I Come Now to shew the probability, I am provok't to say certainty of ~~that~~ /those\ sources In Nature, (because there can, as I thinck, be no other) whence y<sup>e</sup> action wee call light proceeds. I am sure if ~~it~~ /such\ be made out possible, y<sup>e</sup> Necessity of the thing will make ~~it~~ /them\ certain.

We build on y<sup>e</sup> plenitude of y<sup>e</sup> World, and that Influences are Conveyed by perpetuall Contact, according as wee see all buisnesses done amongst us, & Nothing of contradiction in it; what rule Els, have Wee to be guided by? M<sup>r</sup>. N. calls this a chimera. What is his vacuum ffull Infinitely over & over againe with corporeall light? But Not to argue these points over againe, wee will assume y<sup>e</sup> Generallity of the Cartesian Hypothesis;<sup>168</sup> and that y<sup>e</sup> Whole Ether or Mundane fluid, Moves about y<sup>e</sup> Sun, & that about its center. And y<sup>e</sup> planet's Swiming as  
body's

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<sup>168</sup> Here we get the sense that RN is addrssing someone who has already read the cosmogrphy as described in 'The World' (earlier in this volume).

body's poised In Water, without concerne In the  
 cours, but wholly passive, & some surrounded with  
 a body of Ether, In y<sup>e</sup> Same Manner Moving about  
 them, with subplanets, as is knowne to the abece=  
 darian's<sup>169</sup> In Moderne astronomy; This centrall Motion  
 of y<sup>e</sup> World Makes a [scecerning?] of y<sup>e</sup> matter of it  
 In y<sup>e</sup> Manner of fermentation, and the most power=  
 full by a strait tendency Comon to all Such Mo=  
 vem<sup>ts</sup>, p<sup>r</sup>vaile to Recede, and the less descend tow=  
 ards y<sup>e</sup> center. The Necessity of this has bin proved, &  
 that the Smaller, or Centripetall matter, must have  
 the most swift action, & generally is aptest for fire,  
 Hence it is y<sup>t</sup> y<sup>e</sup> heaviest body's have y<sup>e</sup> most Subtile  
 parts, and some More apt, & other less, to Move,  
 from the forme, & Composition of them (I Shewed y<sup>e</sup>  
 Composition, or, in y<sup>e</sup> filosoficall terme, Continu=  
 ation of body to be Infinite In y<sup>e</sup> way of Minuteness)  
 as Gold, Quicksilver, lead, &c. w<sup>ch</sup> hold a solidity, While  
 other's more active, are volatile Every where; ffor  
 the Irregularity of component parts is such, as Must  
 have perpetuall Interstices, & those filled, with less  
 & others In y<sup>e</sup> Interstitii of them, & so to Infinite  
 Just as wee see upon a beach; stones with sand  
 among them, and water amongst ~~tht~~ that  
 [&c?]. and body's being In action, as fluidity Shews,  
 by perpetuall Intersmiting, conserve, and It  
 may be

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<sup>169</sup> On the one hand we can read this as meaning much the same as 'beginner'. But it is possible that RN is obliquely referring to a kind of determined self-exclusion from knowledge - 'Abecedarian' was a name given to a group of radical anabaptists in early-16th-century Germany who renounced conventional, worldly knowledge in favour of direct communication with the Holy Spirit.

may be Inceas y<sup>e</sup> activity of y<sup>e</sup> world; All wch matter have, or should have their, to w<sup>ch</sup> wee Referr the fuller discussion of them, but thus Much is Remem= bred ffor composure sake.

I take light to consist in y<sup>e</sup> Subtiler matter of y<sup>e</sup> world, and Not In the Grosser. ffor air to light is No better then cristall or Glass; so also water y<sup>e</sup> Same onely permeable, and hindring rather then aiding the Cours of it. The pneumatick Engin shews, that light is No whitt disturbed by the Exhaustion, and body's In the barometricall spaces are seen as Well as when No Mercury is In y<sup>e</sup> tube. And No opacity or so Much as dullness comes from want of Comon air. By y<sup>e</sup> Same Engin wee discover Sound to depend on y<sup>e</sup> Gross air, & Not on y<sup>e</sup> finer matter, and will be but faintly conveyed, if att all, by it. Therefore Sound is a movement by succession, but light In an Instant, or So Near, as may well be accounted So; The reason is the perpetuall contiguity of matter on w<sup>ch</sup> it depends. ffor wee know y<sup>e</sup> air is a yeil= ding body, & takes Compressure; but y<sup>e</sup> univers Cannot yeild, and that w<sup>ch</sup> Crouds y<sup>e</sup> Whole Mass of y<sup>e</sup> Subtile matter of y<sup>e</sup> world, Must set it going all at once or Not at all; of If there be any time<sup>170</sup> It is by accident, from y<sup>e</sup> Inequality, and Irregularity  
of

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<sup>170</sup> i.e., delay.

of y<sup>e</sup> Medium & its Component parts. I know the late  
 vertuosi argue strongly, that light is an emana=  
 tion actually [movent?] from y<sup>e</sup> luminary; becaus it  
 is found that some (tho very Inconsiderable time  
 Is spent in Crossing y<sup>e</sup> anuall orbit of y<sup>e</sup> Earth.  
 W<sup>ch</sup> they prove by the Satellite of Jupiter, w<sup>ch</sup> in y<sup>e</sup>  
 Earth's neerer position Comes neerer the calcu=  
 lation, then when Remotest, and tables of Equa=  
 tion are Made to Reduce that time, & correct y<sup>e</sup>  
 tables. to w<sup>ch</sup>, first with due Respect to calcula=  
 tions, wee will admitt a great thing, that there  
 is No Error In them. Next admitting a perpetu=  
 all Contiguity, and y<sup>e</sup> Motion Conveyed as by one  
 long staff thrust from Jupiter hither, yet the acci=  
 dent of things will loos Somewhat, as by Inconsidera=  
 ble startings or slippings of parts. to Make this proba=  
 ble, suppose a Rodd of Iron pushed End ways, It will  
 be Granted that [æe?]moter End moves at y<sup>e</sup> same  
 Instant, with y<sup>e</sup> other, where y<sup>e</sup> force is applyed. but  
 Imagin the rodd Continued In perfect strait, & sus=  
 pended (to take off y<sup>e</sup> friction) for 100 Miles In length,  
 it is hard to beleev that y<sup>e</sup> whole length Should take  
 y<sup>e</sup> Motion all In y<sup>e</sup> Same p<sup>r</sup>cise Instant; And it is  
 allmost certein that accident among the compo=  
 nent parts, will bate a litle at y<sup>e</sup> farther end, tho  
 the motion is Conveyed by perpetuall Contiguity.  
 therefore

Therefore, I allow Not y<sup>e</sup> argument, for y<sup>e</sup> actuall  
 & progressive Emanation of light, from that Scruple  
 of time, (for what is a. 2<sup>d</sup> or two /of time\, to y<sup>e</sup> /Space of y<sup>e</sup>\ diameter of  
 y<sup>e</sup> Earth's orbit) found In y<sup>e</sup> passage of light from the  
 Satellits of Jupiter; but adhere to the Influentiall Mo=  
 vement of y<sup>e</sup> Whole Medium, after y<sup>e</sup> Example pro=  
 posed of water, Struck upon y<sup>e</sup> Surface of it.

Now to Consider whence that force Comes, to have Such  
 an Immens Effect, as it seems to be, affecting our or=  
 gan, from scarce conceivable distances, I begin with  
 our Grand luminary the Sun. I take that to be a  
 body of fire, but Not of such purity as it seems to  
 us; for whatever clots, or sinders May be of ~~opa~~  
 opac matter, they are small In Comparison, of the  
 body of y<sup>e</sup> Sun, & So lost in y<sup>e</sup> Spreading light. yet  
 Some are of y<sup>e</sup> Magnitude, Whither smoak (w<sup>ch</sup> will  
 hinder light,) or combustible Matter, that the Naked  
 Ey at Our distance will discover them. and by y<sup>e</sup>  
 appearing & vanishing of them, It is found they /are\  
 /Spotts\ Residing upon y<sup>e</sup> Surface of y<sup>e</sup> Sun, and move In y<sup>e</sup>  
 Strict rule of perspective, as thing's appear &  
 vanish upon a turning Globe. So also there are  
 faculae or ~~Spotts~~ /Specks\ of light, that are as New kin=  
 dled fires; but In Short /great\ fire, as y<sup>e</sup> Sun is, wee Must  
 thinck ~~of~~ is attended with y<sup>e</sup> like Disorders & acci=  
 dents as wee know belong to our ~~Greater~~ /lesser\ fires here.



And In sume,<sup>171</sup> wee account it a raging, melting, hissing[,]  
 flowing, furious fire that Composeth y<sup>e</sup> body of y<sup>e</sup> Sun, Most  
 Resembled by the flows of fire y<sup>t</sup> breaks our upon Eruption[s]  
 of Mount Etna, onely universall there, as that is but a  
 point in our Globe; but May be that be understood  
 how y<sup>e</sup> whole body of y<sup>e</sup> Sun May be a burning Impetu=  
 ous Mass. ~~but~~ It hath this difference from our fires, that  
 y<sup>e</sup> latter if Not by accident kept together dissipate &  
 Extinguish, but that can Never Extinguish becaus all  
 y<sup>e</sup> Combustible matter is brought there by y<sup>e</sup> Gravity of  
 the **orbis magnus**;<sup>172</sup> and If any be throwne off by the  
 fury of the fire it Returnes againe. Nor doe I Contend  
 ffor Cartesius fancy of a cours from y<sup>e</sup> Equinoctiall  
 to y<sup>e</sup> Center, and so out by y<sup>e</sup> axis, continually, tho  
 the Magnetisme of Iron, & Some other body's, seem to  
 argue such a cours; but it concernes Not this propo=  
 sition.

I account there is a perpetuall Crouding of the Com=  
 bustible matter, w<sup>ch</sup> is of y<sup>e</sup> kind of y<sup>e</sup> permeating Subtile  
 matter of y<sup>e</sup> World, upon the Surface of y<sup>e</sup> Sun, and as  
 Rarefaction there takes place, (supplyd Still by a Sub=  
 tiler matter) y<sup>e</sup> burning Surface allwais beat's upon  
 the ambient matter, w<sup>ch</sup> is action & Reaction, and  
 disperses in Ray's thro the whole orbit and beyond  
 as all motion (Even ~~y<sup>e</sup> least~~ /y<sup>e</sup> most contemptible)\ is propagated In Infinitum,  
 as wee thinck is proved In y<sup>e</sup> laws of Motion. therefore  
 how great soever the Sun is on y<sup>e</sup> one side, w<sup>ch</sup> a  
 puny astronomicall fancy will Render Most Imens,  
 yet on y<sup>e</sup> other side, wee may affirme, that whatever  
 it is

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<sup>171</sup> Change of pen/ink on this page.

<sup>172</sup> i.e., 'great orbit', a term used by Copernicus to describe the orbit of the Earth about the Sun; RN is referring here to the balance of fiery and earthy elements which drive the smaller particles of fire towards the Sun and the larger particles of heavier elements outwards.

It is, If any thing, It is Sufficient, while No other is Greater. ffor sence is offuscated by attention to the greater, and a greater Sends a greater force, w<sup>ch</sup> is Included in it, and So Cannot be distinguished. So it is that y<sup>e</sup> Starrs are Not seen at Noon day, becaus y<sup>e</sup> ordinary Illumination of y<sup>e</sup> Sky from y<sup>e</sup> Sunns Rays Every where Reflected Small body's turning in it, is of more force then the light of y<sup>e</sup> Starrs, and almost Equall to that of y<sup>e</sup> Moon. So the lesser force is drowned & lost in y<sup>e</sup> Greater, When Covered by it. but In y<sup>e</sup> Sun's absence what a force hath all those small luminary's therefore If the beating of the fire of w<sup>ch</sup> y<sup>e</sup> Sun's face is composed, upon the ambient fluid, w<sup>ch</sup> propagates any force, as Some Must be, when it is farr the greatest of y<sup>t</sup> sort in y<sup>e</sup> World, Wee Must perceiv it, and admire its Excellence above others. And for that wee have an organ /y<sup>e</sup> Eye\ adapt, Into w<sup>ch</sup> onely Subtile Matter, w<sup>ch</sup> Convey's this force, can penetrate, and a tablet at y<sup>e</sup> bottome Conserved In all tenderness with humours, to Receiv the Impression from it. therefore the Question is Not, whither this force be sufficient or Not, but whither it is any thing, for admitt y<sup>e</sup> latter, I will make Small ceremony to affirme, be it never so small, y<sup>e</sup> Sence may be so Nicely Exquisite to Meet with & Receiv it.

But this way of discovering of the force of y<sup>e</sup> Sun's fire breaking upon the Ether next to it, is a litle confused & doth Not give a Notion clear Enough, to Make appear plausible what I mean. therefore

If it

If it be asked how that action is done, whither by Great /lumps\ or small parts, I must ans<sup>w</sup> by y<sup>e</sup> ~~very Smallest~~ /latter they then\ as well as any other, for In fire operates the ~~Smallest~~ /must be yet smaler Every where pervious not concerned in this\  
 (pardon y<sup>e</sup> word) of Matter. ffor /action\ the Sume of the Stri=ving of all y<sup>e</sup> Minute parts of y<sup>e</sup> Surface, to dilate, and againe, (w<sup>ch</sup> amounts to y<sup>e</sup> Same) of the conterminous Ether to contract it, (there being still a /of the\ finer Matter to accomodate Rarefaction & condensation, as one or other Gains Ground, by passing to & fro, as pleni=tude Requires.) Composeth the force of y<sup>e</sup> whole. for Every totum is Compound of its parts. Then the Exility of this action supposed to Come from Such Mi=nute Stuff, is answered by Extent and Number of them. And that magnifyes Enough. It is No uncomon thing ffor Small Effects, by union of Many, to become Gross. As In an Evening neer a great towne y<sup>e</sup> voice of one person would Not be perceived, but y<sup>e</sup> Nois of y<sup>e</sup> all that are talking Make a Confused Hum. this May be heard at the Exchang In london, or any fair, or assembly of people, at a distance, where you Could Not hear one man speak to another, you Shall hear a Con=fused Nois. The falling of one dropp into Water, would Not be heard, but a Shower makes avery great Nois. And yet No sound there is Greater then that of one dropp, but y<sup>e</sup> Aggregate of all is very Considerable. So the Strokes of any one part of y<sup>e</sup> Materiall Surface upon another In y<sup>e</sup> Ether, would be as Nothing, but y<sup>e</sup> unconceivable Number, tho of y<sup>e</sup> Same, raiseth a  
 force

force, motion, Influence, ray's, call it as you pleas  
 In y<sup>e</sup> Whole body of y<sup>e</sup> Ether, & conformable fine  
 Matter of y<sup>e</sup> World, that acts as Water Struck on  
 the Surface by Right lines, to Great Extent answe=  
 rable to y<sup>e</sup> vast power of y<sup>e</sup> Caus; and Where organ's  
 are placed in y<sup>e</sup> way of it, Impression is Made, of w<sup>ch</sup>  
 wee are Sensible & call it light.

It is to be No Wonder that wee ascribe such Glory  
 to this sence, or rather y<sup>e</sup> object's of it; becaus the  
 organ is so very Exquisite & Singular; but this  
 is The Concept of y<sup>e</sup> vulgar, for one that Considers  
 Right, will Conclude, that here is No Glory or per=  
 fection at all In y<sup>e</sup> action w<sup>ch</sup> Causeth in us that  
 Sence, more then In any other action or passion of  
 body, being onely loco-movement, & Nothing Els.  
 And that purity w<sup>ch</sup> Wee fancy In light (as if it were  
 ray's of y<sup>e</sup> devinity it self, and whereof y<sup>e</sup> Injoyment,  
 or Not, was by y<sup>e</sup> ancients Made y<sup>e</sup> onely difference  
 between life & death,) is onely y<sup>e</sup> purity of our organ  
 and the soul that attends it. ffor it is In our Nature  
 to be Sensible of light onely from that part, and  
 Every thing y<sup>e</sup> is sensible from thence, gives an Image  
 of light. as a finger, at y<sup>e</sup> Externe angle of y<sup>e</sup> Eye Shut,  
 makes a Sense of light, as If it were a luminary  
 and a Stroke on y<sup>e</sup> Ey like of a fist, Makes light flash  
 as lightning, and y<sup>e</sup> fist is No luminous body; therefore  
 let it

let it be fairely Consented; that Such an action as I  
 Suppose proceeding from the ardent Motion of All the  
 minute part's of y<sup>e</sup> Sun's surface, passing quasi Instan=  
 taneous, from y<sup>e</sup> luminary to y<sup>e</sup> organ, & that by y<sup>e</sup>  
 Mean's of perpetuall Continuity of parts, May and  
 very probably doth Impress Such sence, as wee Call light.  
 And Not deminishing our admiration at the Devine  
 Economy of y<sup>e</sup> world, w<sup>ch</sup> is Never Enough to be admired,  
 but Inlarg our admiration of a greater Miracle In  
 the formation of animall's, & their organ's of Sence,  
 w<sup>ch</sup> from y<sup>e</sup> other, creates New being's, not Extant but  
 In them, of all those beauty's w<sup>ch</sup> the Comon & Inani=  
 mate process of things In y<sup>e</sup> World Causeth In y<sup>e</sup> shapes of  
 light, colours, sound, & other Injoyments of Sence. but  
 of this More then Enough, being y<sup>e</sup> part of an orator, &  
 Not of a philosofer, to Amplifye In termes of Wonder.

I come Next to that ordinary luminary wee Injoy  
 In Severall formes, but In one word is fire. this wee  
 see scarce Ever is found without light, and is So  
 circumstanced, as to serve for proof that y<sup>e</sup> suns  
 light is occasioned by fire, as y<sup>e</sup> Sun also is (being  
 supposed a fire) that all fire Should be /carry\ also light.  
 My hypothesis of Comon fire with Respect to light,  
 is borrowed from y<sup>e</sup> proper discours of it. and is that  
 The pressure of y<sup>e</sup> Atmosphere, is y<sup>e</sup> Caus wee hold it  
 Els It would depart, & dissipate. ffor I Cannot Con=  
 ceiv

=ciev, fire Can Well subsist, but In y<sup>e</sup> Center of Some celestiall vortex, as y<sup>e</sup> Sun Eminently is, w<sup>th</sup>= out such a Conservatory as y<sup>e</sup> atmosphere; that is our comon air, Continually pressing upon it. It is my opinion that where ever air Intermixes there is No fire, and Consequently No light. As when a Coal Glows and twinkles, I take y<sup>e</sup> atmosphere to be ex= cluded ffrom Entring those spiracula made by y<sup>e</sup> fire; and that is y<sup>e</sup> onely difference between smoak & flame. ffor while y<sup>e</sup> air mixeth with y<sup>e</sup> Exhaled parts that Issue by heat from Combustible matter, it is smoak but apply flame, & set that smoak on fire, and y<sup>e</sup> air is Excluded, and It becomes also flame. All w<sup>ch</sup> I have Explained more copiously Elsewhere; But the Result to y<sup>e</sup> p<sup>r</sup>sent porpose is, that fire is Not lumi= nous till it hath strength to fend-off the atmosphear. So as a Candle (for Instance) our Comon domestick luminary, bears out y<sup>e</sup> atmosphear, and Susteens y<sup>e</sup> whole weight & force of it, as y<sup>e</sup> Baroscope doth. And I think this is sufficiently proved by the pneu= matick Engin; ffor No fire will continue In the Re= ceivor Exhausted;<sup>173</sup> And No Effect is So Constant & visible as that; besides that, Wee may Consider If air did Not Clasp fired coals very hard such small agitation of it Could Not Rend & clear as it doth in Comon blowing w<sup>ch</sup> Exasperates fire to Rage.<sup>174</sup>

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<sup>173</sup> Air pump experiments had shown that fire would not burn in an artificial vacuum.

<sup>174</sup> The terminology of kindling here is reminiscent of the language of Descartes 'Of the Passions', and both are reminiscent of the thory of the humours, a scholastic theory of causation. The language of fire is still haunted by such psychological conceptions, and of course crosses back over into the language of psychology. The humoural conceptions also shape RN's (and Descartes') notion of the aether within things (over page), the eminently subtle material, so universal, that it approaches the condition of spirit and closes the boundary between the divine and the material. This is invoked not only the cosmography, but also in the psychology of Descartes and his followers.

Then admitting fore to Exclude the atmospher, it  
 [leas?] No difficulty why it should be luminous. ffor what  
 a considerable action. & reaction is there? and all upon  
 The subtiler Matter, where the firey parts act. the Grosser  
 are clasped with y<sup>e</sup> Ashy less fired parts, and upon Mo=  
 tion rends them off, & letts loos y<sup>e</sup> Sulfur, w<sup>ch</sup> gives y<sup>e</sup>  
 Effect to blowing, but the striking action is of the  
 subtile matter of fire, upon the subtile Matter of y<sup>e</sup>  
 air, and by that mean's, the action arrives at our  
 opticke. It will Not be p<sup>r</sup>tended that y<sup>e</sup> Gross air is  
 a Medium of light, but onely a diaphanous body  
 as Glass, cristall &c<sup>a</sup>. but the medium is within it  
 as it is within them; w<sup>ch</sup> demonstrates the convey=  
 ance of light to be by a Subtile matter, that per=  
 meates near a direct straitness the Interstitiall  
 pores of transparent bodys. So Much for the light  
 of fire.

There are but two other sorts of light, one is by  
 Reflection, & the other usually called Corruscation.  
 The former hath bin Explicated Enough In the dis=  
 cours of percussion upon water, & Nothing is added  
 here; onely that when the surface from whence the  
 Reflection is, is Not obdurate as to y<sup>e</sup> porpose but  
 yeilding, the /action\ light is neer as strong by Reflection  
 as direct; W<sup>ch</sup> is Easily Conceived from our Instance  
 of water, of w<sup>ch</sup> take Repeated this observation  
 let A.B. be the water, and a percussion at

C. The vessell shaped as In y<sup>e</sup> figure,<sup>175</sup> the foramen  
 <diagram> at. D. the Influence of y<sup>e</sup> Stroke  
 cannot Come directly at D. but  
 the direct Influence is to F. &  
 Reflected to D.. and there Shall  
 affect y<sup>e</sup> parabolick water-fall  
 neer as much as at eff. F. tho the Influence comes  
 but By Reflection. But if at F. there were Not a Re=  
 sisting Substance, but such as yeilded, then y<sup>e</sup> Influence  
 at D. would be by so Much less. Accordingly as body's  
 have pointed ragged superficies, as fall out to Reflect  
 litle light (for all Reflect some) they appear black,  
 And as they are rugged In different way's yet apt E=  
 nough to Reflect, they are Coloured; If perfectly flatt  
 or rather Neer to it, the Influence Riseth by way /y<sup>e</sup> Rule\  
 of angles, and then, as lookingglass they are opac  
 but when y<sup>e</sup> Eye is placed in y<sup>e</sup> Angle angular direc=  
 tion. But less smooth superficies shew almost In=  
 differently Every Way, becaus the part's, like Such as  
 wee say are frosted, Respe~~ct~~ some or other /of them Regard\  
 Every way part. & so y<sup>e</sup> Eye /In all positions\  
 takes ~~them~~, takes Enough to discerne  
 y<sup>e</sup> object by.

I Shall here take Notice of a very Materiall obser=  
 vation & experim<sup>t</sup> of M<sup>r</sup>. N<sup>s</sup>. that very thin & small  
 body's shew colours, as those of Refractions. w<sup>ch</sup> he  
 argues, is from Reflecting some, & transmitting others.  
 And that it is a property of body to transmitt, or Refract.

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<sup>175</sup> This experiment (or observation) is described in the essay 'Some hints of light & Colour',  
 see f. 181r ff.



The thing is Remarkable in any thin plates of transparent stuff, and also in very small body's as Hair, sand, or any thing Hath a transparency. as for the latter it is y<sup>e</sup> Case of ordinary Refraction, but the other is less usuall to be observed; and he say's that Coloured circles Multyple strangely, as p<sup>r</sup> his book. The Greatest doubt I have of this is, whither these colours are in y<sup>e</sup> object or in y<sup>e</sup> Eye. And while they fall about one center, it is vehemently suspicious, It is the latter. ffor what is More Comon, then to see coloured Circles about a Candle, and other lustrous things, w<sup>ch</sup> is Manifest to be from y<sup>e</sup> humours, & Membranes In y<sup>e</sup> Eye. accidentally, & Not in y<sup>e</sup> object, and with y<sup>t</sup> doubt I leav y<sup>t</sup> Matter.

The other sort of light Called Coruscation, is the Shining of dead & Rotten wood, Glow wormes & the like. The Reson of such lights is y<sup>e</sup> same as from fire, differing onely in Minority. ffor they are Either in body's corrupting, w<sup>ch</sup> is an action of y<sup>e</sup> Subtile Matter In them, or they are in animalls, w<sup>ch</sup> have a sort of weak fire allwais alive in them. And considering how very faint these lights are, Not to be discerned but in great darkness, wee must say, they are as farr below Comon light, as they are below comon fire. of this Sort are the faint accension's In sumer Evening's, w<sup>ch</sup> are the same as what are accounted falling Starrs. the is never seen but neer y<sup>e</sup> Horison, and that by Reflectio[n] from between orders of clouds, w<sup>ch</sup> there are open to view  
and

And So they make a Spacious appearance, from Small occasion; It is Easy to Conceiv from Comon accidents among us, that compositions May happen, as lime, &c to take fire with Wett, or one humor by another, often proved by chimists..

Of all y<sup>e</sup> Experiments I know of light & fire, one the Most considerable, is owing to y<sup>e</sup> Invention of those Gentlemen, Called, phosphorus. It is an high Extract of urin, Reduced to a sort of wax, w<sup>ch</sup> is so subtile, that y<sup>e</sup> very air will make it flame, and there is no safe way of keeping it but In Water. If it be new, & well made, It is Dangerous to handle it, for y<sup>e</sup> flame is penetrant and strikes thro Gloves & y<sup>e</sup> very flesh, and so sudden, that If water be Not at hand, It is y<sup>e</sup> loss of a limb. ffor y<sup>e</sup> More it is rubbed, the more it Exasperates, and If it be of a duller sort y<sup>e</sup> doth Not So readily accend, a litle Rubbing will set it in flame. And that flame is unlike y<sup>e</sup> flame of any liquid Spirit; ffor it looks fatt and thicker then any other. This is obnoxious to both sort's of fire; one a Meer Corruscation, or faint flame w<sup>ch</sup> doth No hurt, and usually attends the Smaller part's of it. for w<sup>ch</sup> Reason, If wrighting be Made on a paper or board with it, the shining will continue very visible, at least a Minute, or longer; and the broken part's or powder of it kept in a Glass with some Water, being shaken will fume & fill y<sup>e</sup> whole Glass with a faint light, ffor it is very apt to fume, and is Nauseous to y<sup>e</sup> Smell, tho very balsamick as the Chimists Say; I once p<sup>r</sup>pared cotton with Gun=  
powder

=powder made fine, and wetted it well with y<sup>e</sup> liquid phosforus, then (to keep y<sup>e</sup> air from it, w<sup>ch</sup> admitted would soon disable its force) I wound it up hard in pellets, with strong thredd, Many times over. and so kept them for some time, at last I opened them, & when y<sup>e</sup> thred was taken off, I pulled y<sup>e</sup> Cotton one way & other divers times, y<sup>e</sup> friction of w<sup>ch</sup>, and Intro= mission of y<sup>e</sup> air, made y<sup>e</sup> Cotton take fire, so as I lighted a Match at it. I gave a ~~Courtier~~ some of thes[e] pellets to a Courtier, to Shew to K. Cha. 2. Who loved filosoficall tricks, and he lost his address that way, by being too familiar with y<sup>e</sup> Court fires, w<sup>ch</sup> [s~~t~~] set his machines at work in his pocket, with out y<sup>e</sup> Ceremony of opening, and he gained No small point, when he discharged his cloath's of them. And this is all that at p<sup>r</sup>sent I have to Say of light, and its variations by Colour. perhaps upon farther perusall /of M<sup>r</sup> Newtons works\ & Study I may add Considerably but Now, - manum de tabula.<sup>176</sup>

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<sup>176</sup> i.e., 'hands [off] the picture', i.e., stop here, that is enough

169r

Rougham. fryday Even

Madame,

Mr L<sup>177</sup>

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<sup>177</sup> The 'L' here has resulted in a puddle of ink (a corrosive ink) which has eaten into the very soft and absorbant paper of this sheet (as has done also in the address and date, above, and also on the edge of the sheet at the top of the page, where an ink mark has resulted in a notch). The letter has been abandoned. The next essay is written on the same, or a very similar, absorbent paper, which is used for the whole essay through to f. 173v. The porosity of the paper and the numerous corrections, employing much ink, have made this whole section very hard to decipher.



Inceptio.<sup>178</sup>

In Nomine domini, &c. was an Entrance  
to all undertaking's, no less pious & Reve=  
rend, then Ancient. It were /well\ if the family /degeneration\  
of Human kind had Not given occasion  
to add as proverbiall, Incipit omne Malum.<sup>179</sup>  
The Morality of that good fforme, was to  
mind men of providence In all they under=  
took, and that their Ends ought to conforme  
to Such good beginning. It is /also\ a sort of Sa=  
crament or oath protesting the Sincerity  
& piety of what is doing. But it is No Won=  
der that since Religion and comon honesty  
are Counterfett, and Made Subserve those  
very practises, wch they are /Instituted\  
directly leveled  
to confound, ~~it is to be Expected~~, that all  
the formes, and Externall Signification of  
Goodness /without y<sup>e</sup> Substance\  
Should be in like manner usurped.  
And /ordinarily\  
as the designe is perfidious, so /is\  
will y<sup>e</sup>  
fals alwais be affected, and Set out beyond  
all bounds of reason and Modesty. ~~there=~~  
~~fore-It~~ /The fals faces of y<sup>e</sup> leading Quakers put me in mind of what\  
hath bin Sayd,  
that hypocrites are  
of good use in y<sup>e</sup> World, becaus they Inspire/~~struck~~\struct,  
the more honest but Ignorant in the  
formes

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<sup>178</sup> i.e., 'beginning'

<sup>179</sup> i.e., 'in the name of the lord all evil begins', a a widely used proverb

of Goodness, & /w<sup>ch</sup>\ In them /often\ produce/-th\ y<sup>e</sup> Reall  
Effects of it. /as with y<sup>e</sup> wretched rable of p<sup>r</sup>sent it plainly doth\ But in an age, as  
ours is, that /hath layd aside &\  
professeth all contempt of formes, (perhaps  
drawne to it, by /observing\ the Hypocriticall use /Ever\ Made  
of them), doth very much conduce to a ge=  
nerall atheisme. ffor the Inferior & Igno=  
rant sort of men /not\ seeing N<sup>o</sup> shew of good /they expect\  
in their Superior's, /as\ w<sup>ch</sup> with them is /{....}/ as they think\ Solem=  
ne looks & language, thinck they have No  
goodness at all, and the next step is /not seldome is to thinck\ that  
Goodness it Self is a vanity. this Must be  
owned as a great unhappyness, w<sup>ch</sup> Nothing  
but a supernaturall Influence upon Go=  
vernours and potentiary's, (In credit with  
the people) Inspiring them by all humane  
mean's, in their power, and cheifly by the  
direction of their owne practise, to Endeavour  
Reinstating good, & pious formes In credit,  
and thereby /to\ recover the reality with those  
who know More f~~er~~ /forme &c\ by Example /from Either Reason or\ their pre=  
cept. I know the ecclesiasticks ascribe this Chang /alteration\  
/from antiquity\ to the late chang of philosophy in y<sup>e</sup> World, w<sup>ch</sup> that  
hath put men in a more nice method of Inqui=  
ry and satisfying [~~them selves as?~~] themselves /about\  
naturall things; w<sup>ch</sup> they /occasioning them\ forthwith apply /transfer\  
to cases of Duty,  
w<sup>ch</sup> ought to be guided by /a\  
different Spirit.

And for that reason, they Especially of Rome,  
 Have Endeavoured by all the /raging\ ways of autho=  
 rity, /& punishment<sup>s</sup> \ argu (perswasion, & ~~punishments~~ /is not in fashion with them)\,  
 to amor=  
 tize New philosophy, & revive y<sup>e</sup> old, or Els, rather  
 then fail, /to\ have none att all. I cannot say /that\ with  
 us, there is such a round Cours taken, but it is  
 manifest by all the /latter\ plausible pieces Relating  
 to philosofy that Come from y<sup>e</sup> clergy & their  
 Nursery's the university's /they unanimously\ bear very hard u=  
 pon Cartesius, as If he were an author of a  
 pervers heresie, and his disciples, a crew of  
 fond beleeving Ignoramouses. I shall have far=  
 ther occasion to touch this String, but at p<sup>r</sup>sent  
 I mention it onely to shew that the Men  
 of the gown, aim to restore piety by Introdu=  
 cing the Ignorance, or backwardnes of former  
 ages. But I think they are all out of the Way  
 ffor Many reasons. 1. They are forc't to use  
 y<sup>e</sup> Methods of new philosophy In arguing ag<sup>t</sup> it  
 ffor Since y<sup>e</sup> world is so farr possest of the Me=  
 thod of doubdtng, and searching knowledg  
 by distinguishing what is clear, from What is  
 Not so. they must hold forth their tenent's  
 upon clearer reasons, then formerly would  
 have served y<sup>e</sup> time. and this looks Not so  
 candid, ffor why must they rail at and de=  
 preciate cartesius discovery's and plainly in  
 so doing /it~~-use~~ use\ almost use /methods & almost\his words. 2. It is Impossible  
 to



to put men from a cours they /Now\ thinck apter for  
 discovery of truth, then that w<sup>ch</sup> was formerly  
 In use. And so long as there is a corner of y<sup>e</sup>  
 world free, men will from thence, write & dispute,  
 and so Informe y<sup>e</sup> world, in spight of all Expur=  
 gatory means/tion's and Combination's\ whatever. And therefore I thinck  
 it a vanity to goe about /to discourage if not to suppress\ it as they doe.  
 3. But what is wors, It will be Construed a  
 right downe fraud, to p<sup>r</sup>tend to Invite y<sup>e</sup> people,  
 and Not let them see their way. ffor while they  
 thinck themselves masters of reason, they will  
 Expect to be treated frankly & /& as to them seems\ reasonably. So  
 that /urging meer\ authority will be Called Imposing, & bea=  
 ting downe men of candor and clearness of  
 argum<sup>t</sup>, will be /&\ construed /as done\ least by the help  
 of their reason's they /men\ Should avoid /Escape\ being Chea=  
 ted. this is Se /a most\ Naturall a Consequence of the  
 Expurgatory act's of Rome ~~that they are~~ /for w<sup>ch</sup> they are and they really of [...?] it  
 is\  
 scandalous for them, as designing /thereby\ to hood=  
 wink y<sup>e</sup> World; and ffor one proselite they gaine /by it\  
 among the men of speculation, they loos thou  
 sands. Mons<sup>r</sup>. Rapin<sup>180</sup> one of the prime Witts of  
 france, but a jesuit, hath treated y<sup>e</sup> Subject of  
 philosophy, as an ass Mumbles thistles. he would  
 hold to this /very\ designe, and yet keep his credit  
 w<sup>ch</sup> are Inconsistent. his way is, to cry up the  
 ancient Greek philosophy, & batter the New  
 as Much its Inferior, In use to it. and by  
 way

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<sup>180</sup> René Rapin (1621-87). RN could have been stimulated by the publication of *The Whole Critical Works of Monsieur Rapin Newly translated into English by several hands*, London, 1706. On the other hand, Rapin's *Les Réflexions sur la philosophie ancienne et modern, et sur l'usage qu'on en doit faire pour la religion*, Paris, 1676, had been translated as early as 1678 under the title *Reflexions upon Ancient and modern Philosophy, and on the Use that is to be made therefore in religion*. RN was anyway perfectly comfortable with French, so he may well have read the *Les Réflexions* when it first appeared, during his early years in London.

way of Contempt, he Calls y<sup>e</sup> New philosophy  
 meer naturalisme. I would ask him, Whither  
 is the subject of knowledg, Nature or Ima=  
 gination? If the Cobweb of the brain, that  
 is exercise of the Imagination with all the  
 force of the humane witt, is what he Recomends,  
 I Grant the ancient's had it, as also Much  
 More Industry and Eloquence then Wee. but  
 If he would have us beleev, that they knew  
 more of the world, as well in Generall/s\ ~~Compreh=~~  
~~ension~~, as in particular discovery's then the  
 latter ages, I beg his pardon. he allow's the  
 Modern's an advantage by Some Experiments<sup>s</sup>  
 w<sup>ch</sup> hath Made them better at phisicks, then  
 the ancients, but that with him is but a  
 Sorry advance. there is the je ne scay quoy<sup>181</sup>  
 of Rapsody to be admired among y<sup>e</sup> an=  
 cients, above such Groveling Stuff. I doe Not  
 Intend to Carry on a Comparison, but onely  
 to observe that these Remarqs Come Not from  
 Mr. Rapin's Judgm'<sup>t</sup>, but policy. and that he  
 is much an honeste judg of poetry then of  
 philosophy. for certainly there is really No  
 philosophy at all but of Naturall things,  
 or as he say's, meer phisicks. What are Me=  
 taphisicks, In w<sup>ch</sup> also wee have out gon y<sup>e</sup>  
 ancients but a foundation, of Naturall phi=  
 losofy, and Mathematicks, but a branch of  
 it

---

<sup>181</sup> i.e., 'je ne sais quoi', a certain something

it, Capable of more certain proof's, then other part's of naturall philosophy, for w<sup>ch</sup> reason Some care not to goe out from it, or further then the Methods of that Science will bear them, & so dwell upon Eternall subtilizing on the property's of figure & Number; other's are ffor a larger landscape and affect variety and Con[=]jecture /of w<sup>ch</sup> loos sect I take my Self to be one\, Some dwell on the first rudiments of

knowledg; And so according to these Severall designm'ts, wee have logician's Metaphisitian's Naturalist's, Mathematitian's. &c. but the Subject of them all is Nature, that is things existant in fact, or plainely possible. /or nothing\ and If wee are Not pleased with Mistery & jargon, that ~~Explaines Nothing to us~~, fills us with words, & Not with thing's, & /In fine\ leav's us less More dark & Confounded then it found us, he must Excuse us.

4. Another failure of this /Roman\ policy is their Re= comending the mathematick sciences So Much as they doe. ffor What can dispose Men's minds to Certainty's /more\ then ~~they that hath~~ /a sciences w<sup>ch</sup> hath\ In= contestable truth's to build on, and Rejects all argum<sup>ts</sup> w<sup>ch</sup> are not Reducible to them? I Would ask any of them, why may wee not Carry the property's of circles /sphears\ ovals, &c, as farr as the planet's /to solve the appearances of them\ as well as use them at home in /Geometry perspective\ Dyalling. &c. ~~but~~ this /they recomend but y<sup>e</sup> other use of y<sup>e</sup> Same th[ing?]\ /they\ care Not for, ~~but~~ & discourage: as If truth were Confined to Small things

Small thing's, and ~~when thing's were~~ /being\ plac't  
 out of feeling, they must be banish't our un=  
 derstanding's also ~~the~~ /and yet\ our Sences fasten on  
 them and ~~Excite~~ /excite\ our Curiosity /~~more-greatly~~\ rather /'s More\  
 concerning Great then Small objects;

After all I cannot deny, but If this Relaps  
 Into Ignorance & credulity Could be obtained  
 It would much subserve y<sup>e</sup> ambitious Ends of  
 aspiring men, who find ductile Ignorance  
 more for their turne, then troublesome Inquisi=  
 tiveness. but it will Never be Compos't with=  
 out Some vast chang In y<sup>e</sup> State of y<sup>e</sup> world,  
 litle less then y<sup>e</sup> universall deluge. And these  
 Mistaken tricks of Concealing, suppressing,  
 prohibiting, & discouraging, /&c.\ y<sup>e</sup> Mean's of know=  
 ledg, as y<sup>e</sup> world Esteems them, doth ten times  
 more p'judice to goodness, then all they Can /so\  
 hope for ~~out-it~~, to advance it. ffor Nothing  
 In y<sup>e</sup> world creates ~~so-Much~~ /more\ aversion, as /then\ artifice  
 & disingenuity, /ffor it Imply's contempt, then w<sup>ch</sup> there is Nothing Men less patiently  
 Endure.\

Now I Expect to be asked what Cours I would  
 Recomend, In the room of this, I disclaim agt?  
 I ans<sup>w</sup>. returning to my first discours, that It  
 is the more Curious, and active as well as opu=  
 lent part of mankind, (who are but ffew  
 to y<sup>e</sup> whole body of y<sup>e</sup> people,) that are to  
 be dealt with In these affaires, ffor their  
 help

Help, towards keeping the Rest in order, and there is No Mean's with them, but the clearest of dealing, and freest from art or deceit. ffor I Must say againe, as the Governours, so are the people.

Now I am of opinion that philosophy (w<sup>h</sup> I must say is all Naturall or subsidiary to it,) may by /In\ being freely Enterteined, /may\ be In Some sort /be\ prjudiciall to Men's power dominion & greatness by /built upon\ ruling others /other mens minds, & thereby their person & fortunes\ but Not att all to the true Ends of piety & vertue. That truth May be abused, who will deny? men will distort reason's, as well as authority, to wicked purposes; were there no wicked people in the Reigne of Aristotle? or are there any where /not\ worrampines warrs, carnages, Immorality's or blasphemy's, then /were\ In former times? I thinck Not, but Shall Not dwell on ye Comparison. And at p<sup>r</sup>sent give my plaine sentiment that ~~Nothing will~~ the foundation's of piety & vertue, Rely More on the force of reason, then on any authority, ffor authority, whatever it be, is precarious, unless it be Supported by reason. therefore Since there is No way to move the better part of Mankind, then by clear and Enforcing reason's, w<sup>ch</sup> are sufficient ffor the Ends proposed, It is best to lay aside all party and faction<sup>183</sup>

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<sup>182</sup> Here, as elsewhere, RN gets his numbering wrong, this is page 8.

<sup>183</sup> The text stops here. It could be the actual ending of the piece, but I find that unlikely (not for any demonstrable reason, nor upon any particular authority).

Newton.

1. fol. aer duplo densior In duplo Spatio Quadruplus  
est.<sup>184</sup> - Rectissime

2. It is supposed matter is Not disturbed in any state  
without difficulty.

I doe not like that way of expression, such as  
vis Inertia<sup>e</sup>. & y<sup>e</sup> like. ffor It is no More a throw of force  
for body's y<sup>t</sup> Meet to part, then to goe on in a  
direct cours; but the fancy is from our conceiving  
owr owne force, & Comparing with that.

5. Tempus absolutium<sup>185</sup> &c. that is a true and Mathe=  
maticall time, without Relation to body, flows equally  
- This I deny time, abstracting body, is Nought. body  
is measure, or demension, w<sup>ch</sup> is transferred to time. take  
away all measure by body or its Image (as Wee Conceive)  
Space, and time must be gon.

It is not Strang that this concept is so difficult, I might  
say absurd to our understanding, w<sup>ch</sup> cannot Make an  
Image or Idea, of time-less-ness: It is just the same as  
when wee conceiv any thing, it is under some Measure  
for all wee know of our selves is body, and that wee feel  
it. therefore I wish filosofers Not to argue the Necessity  
of thing's, from the Necessity of their conceptions.

6. There are much paines taken to Make men Conceiv  
the Relation of Motion, so that In Some Respects things  
Move, & In others Stand, and thence grow distinctions /of Motion &  
of place, absolute & Relative, and of Men walking in Ships  
under sail; w<sup>ch</sup> consideration's Enterteined y<sup>e</sup> vertuosi  
In y<sup>e</sup> Infancy of New filosofy; as May be Seen In y<sup>e</sup> disputes  
of Gassendi ag<sup>t</sup> y<sup>e</sup> tolomaik systeme.<sup>186</sup> and So here. Whereas  
one would thinck y<sup>e</sup> World Should have Now a clear Intu=  
ition of that whole Matter w<sup>ch</sup> is but In short, that  
as you goe to or suppose, body's continuing or Changing  
place & distance with respect to Each other, they are  
sayd

---

<sup>184</sup> i.e., 'air of a double density, in a double space, is quadruple in quantity' (from Motte's translation, London, 1727) These notes reference Isaac Newton's *Philosophia Naturalis Principia Mathematica* first published in 1686/7 (second edition 1713). There is clear evidence that he used the 1713 edition (see below, f. 177v). The coordination of ideas and polemic argue strongly that many, if not all, the 'Newtonian' papers date from much the same time. RN starts here at the very beginning, engaging with the very first definition. Although he does not produce a comprehensive analysis and critique of Newton (he very soon drifts into characteristically RN discursive commentary), we might wonder if he considered producing a Newtonian *Examen*.

<sup>185</sup> i.e., 'absolute time'

<sup>186</sup> Pierre Gassendi (1592-1655); Gassendi could not bring himself to argue for a heliocentric system since it went against the church's teaching, settling for the compromise system suggested by Tycho Brahe.

Sayd to Move or Not to Move; for look at one thing you move at another thing you rest. So that ye Result is that Motion, is but a word, by w<sup>ch</sup> men mean they know not what; they would have it Some what, If they Could and yet they Cannot be without it; and In truth Motion and No Motion, Respecting Each body as to it Self is all one, and Nothing more can be Said of a body In Motion (as it is termed) then may be sayd of the Same Going No farther, then If it (as they say) rested. And If one Would give a description or caracter of Motion, or of all that wee can find true in it. ~~that~~ It is, chang of position and distance, & Nought Els. so If yould look for Motion Examine distance & position, & you have it. W<sup>t</sup> happens upon the occurs of body's, I may touch after.

7. I desire to know, what absolute time is? he says the perseverance of thing's in their being; w<sup>ch</sup> Returnes us to our /old\ way of Conceiving time; w<sup>ch</sup> is from Comparison of Movements, when all that while they persevere. &c. but If time be any thing, it Consists /in\ measure, Els why say they <sup>2187</sup> what can that Measure be, but demension under w<sup>ch</sup> wee Conceiv body. then take that away ye other vanisheth.

Then ye paralell between time & space, 1. succession, ye other place, w<sup>t</sup> is it all, but Referring ye Essence of thing's to our Imaginations? I would know If ye Almighty can annihilate all space? they will say, yes; then he might create it, and as much of it as pleased him. and it is (to him) possible, that there Should be any or None without implying any contradiction; why then all these declinations?

8. the gusto of disputing Cartesius definition of Motion, <sup>188</sup> shews with other beating ye bush to define what Every one knows Motion, to be Nothing

<sup>187</sup> i.e., ''; Newton, Principia, 1713, p.

<sup>188</sup> i.e., ''; Newton, Principia, 1713, p..

Except in a Relative sence, as body's Mutually Measure distance betwixt Each other; for If you See No alteration of distance among body's or their part's, w<sup>ch</sup> wee Call position you know No Motion, alltho you and all you see, with others out of view may chang. but y<sup>e</sup> chang is Not in one More then in another.

Therefore once for all let us lay aside these words, as to y<sup>e</sup> ordinary Sence of them, as Giving, Receiving /generating Endeavouring\ partaking Joyning /Depriving\ &c. of Motion. and confine our selves, to know if wee can, what changes, In the casuall occurs of body's, may hap= pen, and to that onely Refer all our language.

A property of Motion, that such as keep position, partake of y<sup>e</sup> Same motion.

9. distinction, of true Motion, & Relative Motion y<sup>e</sup> former is Not without Impuls, tho later May be from other body's Moving. all this is built upon our fancy that force is, as it were a Spirit, for wee feel it, and know the paine & concussion of o<sup>r</sup> flesh, & therefore wee attribute to strokes of Inanimate thing's y<sup>e</sup> like. Where as upon Every Stroke there is as Regular & de= terminate consequences, & as Easy as when body's Move without any concussion.

The Experim<sup>t</sup> of y<sup>e</sup> pail of water, hung by a cord & turned. see another paper.<sup>189</sup> to w<sup>ch</sup> add.

- It rose not at first ] for the sides of y<sup>e</sup> pail twitcheth & So holdeth the Contiguous matter, ~~Not all~~ and Gradually In time that /is\ y<sup>e</sup> Next /then next\ & So on to y<sup>e</sup> Center, or axis. w<sup>ch</sup> parts Striking one an other, drives them forewards, with a force in tan= gents, w<sup>ch</sup> Makes it Swell about y<sup>e</sup> Sides, & dish in y<sup>e</sup> Midle till, y<sup>e</sup> water moves all with y<sup>e</sup> vessell Then it sinks flatt. and It Must be so when there is No Striking at all. for as to y<sup>e</sup> pail or vessell there is No More water Motion then

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<sup>189</sup> He seems to be referring to f. 178r ff., below. See there for a more coherent decription of the 'experiment of y<sup>e</sup> pail'.



175v

was at first, and as to y<sup>e</sup> air, ther is Motion, but Not to lay hold, or draw y<sup>e</sup> part's as y<sup>e</sup> wall's of y<sup>e</sup> vessell did.

Hence y<sup>e</sup> author makes a

The objection to y<sup>e</sup> vortexes, is that ), In view) by y<sup>e</sup> Motion's of the planet's, the periods are timed as 1 1/2 of their distance; and y<sup>e</sup> fluid Must Move (as before proved by a seeming Experim<sup>t</sup>, & argum<sup>ts</sup>) must be in the Quatdraty or duplicate prop<sup>n</sup> of their dist. to w<sup>ch</sup> I say

Negatur, that y<sup>e</sup> vortexes must by parts turne Swift in Such proportion, they May Goe slower further off y<sup>e</sup> Center.

He argues that y<sup>e</sup> force beginning Either from y<sup>e</sup> Center or Circumference of a fluid Inclosed (as vortex) will never leav till it bring y<sup>e</sup> fluid to an uniforme Motion, such as a Wheel the diametrall points of w<sup>ch</sup> Moves in time in duplicate proportion with y<sup>e</sup> distance from y<sup>e</sup> center.

true, but suppose the parts from y<sup>e</sup> Center of a fluid such as are concerned Mainely (for y<sup>e</sup> subtile Matter wtever it is, tho somewhat, yet is Not Intire by [Conexion?] as p~~er~~vius /passing between\ doe become Grosser & Grosser, It cannot be say'd that ever, the subtiler from y<sup>e</sup> Center, Shall bring y<sup>e</sup> Grosser outwards, to the same degree of swiftness (or uniforme as In Wheel) but the heavier Will hang back somewhat, as the Greater being struck. y<sup>e</sup> less shall rather Reflect then Incite y<sup>e</sup> Same degree of Swiftness.

That this is so, y<sup>e</sup> discours of y<sup>e</sup> Reason of Gravity demonstrates.<sup>190</sup>

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<sup>190</sup> This footnote to a page in Newton's *Principia* prompts a short essay on the 'Mathematick Method', begun overleaf.

It seem's appropriate to y<sup>e</sup> subject of p<sup>r</sup>cise Quantity. Cartesius first Introduc't it in philosophy, and others since have affected y<sup>e</sup> Same, particularly Newton. but comendable as it [it?]; like other Sciences grows rude by unskillfull handling, and Not a litle, by sheltring conjectures under an abstruce method, w<sup>ch</sup> all Will Not nicely Examine, & then Q.E.D. closeth the paragraph.

I think it Wholly Improper in phisicks, w<sup>ch</sup> deall Not More in substance but Events. and the axiom's that Relate to Event's are more Exposed to Error then those that belong to pure Quantity. as None can doubdt, but y<sup>e</sup> whole is Equall to all y<sup>e</sup> part's. & y<sup>e</sup> like. but when wee say, like Caus hath like effects, may be also clear, but there is More the application wherein both Caus & effect May be Mistaken; as In that **Flench. Non Causa, pro Causa**.<sup>191</sup> but this is yet good method In y<sup>e</sup> way of argument, & ordinary rea=soning provided, wee doe Not p<sup>r</sup>tend to the Same rigid demonstration, as belong's to Quantity Subsisting.

To Instance Cartesius was Mistaken in his law's of Motion Grosly. as arguing y<sup>t</sup> a less body would Not move a greater at all, & In other Instances of that sort w<sup>ch</sup> about' in his works he holds as demonstrated. because he applyed axiom's to a wrong Subject. So also parties, y<sup>t</sup> set up for his Corrector, Much wors. he would have y<sup>e</sup> least body Move y<sup>e</sup> Greatest with all its swiftness. but It must be done in vacuo; and both

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<sup>191</sup> i.e., 'refutation, non-cause for a cause'

Ascribe the variation In Experiment, to the Medium w<sup>ch</sup> they say alters y<sup>e</sup> Case from the strickt Energy of y<sup>e</sup> force. /movemt\ all w<sup>ch</sup> is tromperie. ffor If a body be struck in pleno at y<sup>e</sup> Instant of y<sup>e</sup> Stroke, it is in all Circumstances as in vacuo, onely so Much as the circumjacent matter hinders the force, w<sup>ch</sup> is Reduced/able\ to /a stated\ Quantity; /It is just\ as If y<sup>e</sup> body in vacuo were So Much bigger, then In pleno; for the plenitude by Quantity make's it. And yet the buisness of Motion becaus, that is In all Respect's adjusted by Quantity of Matter In w<sup>ch</sup> it is considered, is the onely branch of phisicks, that the Mathematick Method Can be reasonably used with.

Experiment and Not axiom is the Ground of phisicks I Grant Multitude of Experiments succeeding alike argue Inductively, So as to Make probable, but Not demonstrate, as the Great luminarys for many century's have held a certain cours, It is Morrally safe to Conclude the Same will continue; but Not so proved, as Mathematicks Require. If it be say'd, without Miracle Interposing it must; for body's In Motion Continue. &c. that is all we know doe so, but it is yet Easier & fairer to Reply that some caus of chang May occur, y<sup>t</sup> Never appeared to us, then to deny Mathematick axiom's. In short Mathematicks properly demonstrates, y<sup>t</sup> is Shews things as they actually Exist by their part's, or w<sup>ch</sup> is y<sup>e</sup> Same thing supposed ~~to Exist~~ /to be\, and In truth /are\ really so In lumps of Quantity, tho No knife can practise the devisions but phisick's deals wholly In Event's, and Reducing them to their primary causes; but Causes are So latent, & various in divers subjects, that Event's of Similar causes May Not allwais

answer<sup>192</sup>

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<sup>192</sup> In this and the following page RN crowds his writing, so as to complete the essay within four sides.

But the Greatest & worst Inconvenience is loss of a world of art & labour. Such as Mr. Newton's work, w<sup>ch</sup> is compleat in the mathematick way, but in phisicks Barbarous, Nor doth his apology of Not asserting phisically any thing, absolve him:<sup>193</sup> ffor In conclusion he doth plainely & stricktly assert an hypothesis More precarious then any of the peripatetick traine. v<sup>st</sup> the mutuall attraction of Matter; Supposing all body's to attract each other In proportion to their Quantity, whereby the planet's, working upon Each other /[-.--?]Reciprocally\, towards Mutuall approach, regulated secundum Magus & Minus<sup>194</sup> by distance & Quantity, and opposed by the principle of Receding from y<sup>e</sup> center, ballanceth their Motions according to their pheinomena. What are Quality's Substantiall formes, Intentionall Species, other this.<sup>195</sup> for may wee Not Say, when one Quality works counter to its opposite, the consequence is a Mediate Station as Mahomet (~~in y<sup>e</sup> fables~~ /legend\ ) In his Iron tombe, between y<sup>e</sup> loadstone & the Earth, and If you will suppose Quality what may Not be demonstrated. ffor you Must Suppose degrees of More & less, then Enter's arithmetick Geometry. &c. but to what End, when the very principle is suppositious; labor actus in orbem.<sup>196</sup>

Now, I Not onely deny, as an opponent, these Notions of centripetall & centrifugall forces, but as a philosofer sincerely declare, I thinck them fals. for I conclude the[re] is No Such attraction nor any thing like /it\ So universall as is p<sup>r</sup>tended. Nor is there originally or otherwise, then as a result of Compound Motions Such a thing as Recess, from y<sup>e</sup> Center of [Motion?] S<sup>u</sup> w<sup>ch</sup> lett y<sup>e</sup> discours of y<sup>e</sup> Subject Shew.

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<sup>193</sup> 'Hypotheses non fingo', i.e., 'I do not frame hypotheses'. This famous quote appeared in Newton's *General Scholium*, first published as part of the second edition of the *Principia* in 1713. The *General Scholium* begins with a devastating attack on the Cartesian notion of a solar system operated by vortices.

<sup>194</sup> i.e., 'only by degrees'

<sup>195</sup> 'Qualities', 'forms' and 'species' are all Aristotelian terms employed in scholastic philosophy.

<sup>196</sup> i.e., 'toil returns in a circle', from Virgil, (redit agricolis labor actus in orbem; the farmer's labour returns in a circle), *Georgics*, lib. II. 401-2

9. Experi<sup>m</sup><sup>t</sup>. A pail hung by a cord, & turned till ~~it~~ twisted very hard; then filled with water and lett goe; as it turnes back, y<sup>e</sup> water at first is flatt, at length riseth at y<sup>e</sup> Sides & becomes more Concave, till conformed in its motion with y<sup>e</sup> pail. w<sup>ch</sup> is

To prove, that It is movem<sup>t</sup> absolute (as he calls it) & Not Relative, y<sup>t</sup> creates y<sup>e</sup> Recess from y<sup>e</sup> center. for while y<sup>e</sup> pail went round & y<sup>e</sup> water Stood Still, w<sup>ch</sup> is a Relative chang of position, No Effect followed, but when Moved round, & kept place with y<sup>e</sup> paill, y<sup>e</sup> full Effect was.

And therefore there is somewhat absolute In motion; and it Consists not wholly, is Relation so as to say, It's no Matter on w<sup>ch</sup> body a Moving force falls, so they separate or approach.

Now I conceiv this Experi<sup>m</sup><sup>t</sup> doth Not prove an absolute Nature In Motion, so as to ascribe y<sup>e</sup> force, or Essence of it, to one more then another body, whilst they approach, or separate, but it doth Indeed prove, that the Motion or recess of adjacent body's to from or by any  
fluid

fluid, or any aggregate Combination of body's  
 so as to creat a Recess from any point, un=  
 till, by Impelling them, they are put into  
 a state of translation, Relative to Some fixt  
 point, w<sup>ch</sup> wee Call a center. for till y<sup>e</sup> pail  
 by the snatching y<sup>e</sup> fluid hath brought it  
 Into y<sup>e</sup> Cours, is Not to be concerned in the  
 buissness, More then the passage of a body  
 at any distance. but y<sup>e</sup> water is as it was  
 at Rest, with Respect to all center.

And when it is put to Move with y<sup>e</sup> paile  
 tho it May be Called absolute being raised  
 to that Gradually by y<sup>e</sup> Convulsion of y<sup>e</sup> Sides  
 upon y<sup>e</sup> fluid, till it Conformes; yet with  
 Respect to y<sup>e</sup> center a fixt point, it is still  
 Relative. and be y<sup>e</sup> cours at unity with y<sup>e</sup>  
 sides of y<sup>e</sup> pail, it is in Constant variance  
 with y<sup>e</sup> center supposed a fixt point, or  
 Considering a cilinder, with y<sup>e</sup> axis, a fixt line.

But still goe to y<sup>e</sup> Reason of y<sup>e</sup> Recess from  
 y<sup>e</sup> Center, Elsewhere given, and it will appear  
 to have No distinction from y<sup>e</sup> Case of Comon  
 Impulses, and y<sup>e</sup> Consequences, therefore these  
 words, absolute, Relative. &c are but Con=  
 founding, Y& Not Informing /or\, fitt for demonstration

And Most others of our English academiqs, as well as  
 p̄forrein Ecclesiasticks, Shew an Indecent zeal agt̄  
 cartes, & his philosophy, as If Religion or state were  
 concerned, partiall New's, such as ye Comon Ga=  
 zettiers dart forth, is fastidious; partiality or  
 faction in History, is detested, but In philosophy  
 odious & dishonourable. Where opinions are Ground=  
 less or Mistaken, confute them, but with Respect  
 to those, w<sup>ch</sup> are Sound and happy, Especially  
 when they are so prime & shining out of an  
 age of reverend & solemn Error In phisicks  
 Such as D. Cartes appeared in. So that ffor the  
 way he shew'd them out of their Ignorant Mazes  
 they Should Shew some sence of Gratitude; and  
 If his refinement's of an hypothesis, had Not  
 the ultimate proof of a generall criticisme  
 (and what one man is Equall to all?) but are  
 open to right downe denyall's, as well as At best  
 p̄carious-ly taken. and all the while his gene=  
 rall method and principles, of w<sup>ch</sup> these Men  
 serve themselves, are Sound & usefull, Justice  
 for their sakes, would pass by ye others, as the  
 Result of thoughtfullness In one buried in New  
 speculation's, and so Exposed by Naturall Self=  
 flattery, to Infinite fondnesses & oversights. but  
 when an author, is, like a Statesman with ye  
 mobb, unpopular among Scollars, all things  
 from

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<sup>197</sup> John Keill (1671-1721) author of *An Examination of Dr. Burnet's Theory of the Earth Together with Some Remarks on Mr Whiston's New Theory of the Earth*, Oxford, 1698.



from him are bad, & to be Refused /or at least Not owned as.\ tho the light  
 of their owne Ey's are /is\ from him. and all his works  
 and favourer's, are treated as a vain sect, and  
 named by him, as In contempt. So that this  
 philosofer among the divers sects & opinions  
 w<sup>ch</sup> he Enumerates, as fantasticall in anti=  
 quity, & of later times, he catalogues that of  
 D. Cartes, as a sort of people fond of fals rea=  
 soning's, and assuming p<sup>r</sup>cariously principles  
 and arguing from thence, Ingeometrically & un=  
 worthy of philosofer's. Why is Not such an Emi=  
 nent author as he worthy of a candid Critis=  
 cisme? why May Not his failings be Shewed  
 and his Excellency's Recommended, with out  
 Satire & Invective? and so as if they were  
 Sorry there was any of y<sup>e</sup> latter, to Impeach  
 their ill usage of him. And Why Should Men  
 claime & use a priveledg, of walking by  
 his light, as Manifestly in all y<sup>e</sup> Way's of  
 Moderne filosofizing, they doe, and yet  
 treat Such as acknowledg his Merrits, & yet  
 allow his failings, As they would a blind  
 vulgar, that follow a faction; calling them  
 Cartesian's, &c. and charging them with right  
 downe Heresie. this usage hath given Me occa=  
 sion to Examine w<sup>t</sup> grounds there are to  
 Impeach this great author, and Wherein  
 they doe him right or Injustice, Not as ad=  
 vocating a sect, but truth.

Some Notes of M<sup>r</sup> Newton's Singular Insinuations.

(2)

1. That light is Corporeal, & darted with Incredible celerity from the luminary all about, and accordingly hath powers attractive, and protrusive, and divers happen In Refractions, from the formation of y<sup>e</sup> Sides of Such ray's, as the usuall & unusuall Ray's together Refracted in Talk, In one pice one way, & In antoher y<sup>e</sup> Contrary.

Ans.

That light is performed by y<sup>e</sup> Mean's of body, and Consequently, must Exhibite appearances, conformable to body, as Reflection &c. is Most true, but that Ray's of light are a stream of body flowing from y<sup>e</sup> luminary is absolutely fals & Impossible. ffor

If light be body, Whereever light is seen, there is that body, and accordingly, the light of a Candle fills a room, for in No other point is to be found, free from y<sup>e</sup> light. but that is Not all, let y<sup>e</sup> room /be\ walled, and ceiled with lookingglass; Each Reflection fill's y<sup>e</sup> room, againe and againe. And what is More wonderfull, these Corporeal ray's, tho each fill y<sup>e</sup> room, doe Not So Much as Justle one and other, for No one light is y<sup>e</sup> More Confused for anothers being p<sup>r</sup>sent; & this holds Not In 2 or three Instances, but Miriads of lights In a cathedrall Church are seen Each by his peculiar Right lined Emanation's as If there were Noneother there. Now Is Not this a prodigy of an opinion, If our Notion of body, Ever hard and Impenitrable be true.

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<sup>198</sup> Crossed-out, pencilled numbering begins with 420 (continuing up to 427 on 187r). The number two, encircled, top centre (just below title of essay).

As to his Colours, appearing upon Refractions, by Mea[ns?] of a different Refrangibility, that is In herent In thes[e?] rais w<sup>ch</sup> Exhibite them. It must be admitted, that [....?] degrees Refracted doe Constantly produce such Colours but it follows Not that there are Corporeall ray's, disti[nct?] from y<sup>e</sup> Matter of y<sup>e</sup> World, imbued with y<sup>e</sup> faculty of [th..?] those Colours, and of being Refrangible. It is Enough to [....?] that /C-\ Refracted /ordinary\ light allwais occasion's in us, suc[h?] Idea, as wee have of Colours, And that colours [one.?] made by Refraction, are Not altered but Continue y<sup>e</sup> [....?] thro all /[future?]\ Refractions; but as to y<sup>e</sup> Caus, It may be from the Nature of o<sup>r</sup> organ's, ~~as well as from~~ or any thing rather then Corporeall ray's.

## Some hints of light &amp; Colours.

Imagine a great lake /pool\ with regular sides, & full of water, with animalls of Exquisite Sence. If a Man with a Great Batle-door, Strikes upon the surface. That stroke raiseth a Wave, w<sup>ch</sup> circles about, till [occurring?] y<sup>e</sup> Sides It Reflects, according to Rule, and So from all, making at length a confused Ripple all over; w<sup>ch</sup> Ripple tho to us y<sup>e</sup> Spectator's seem Confused & as it were Casuall yet hath all its Motion from y<sup>e</sup> laws of progression and Reflection of body's, and So perpetually to and againe to Infiniti, unless other Motion's, as comonly doth, alter or ceas them. this Represent's sound.

At the Same time there is a force In or very near y<sup>e</sup> Instant of y<sup>e</sup> Stroke, upon y<sup>e</sup> Whole body of water, w<sup>ch</sup> may be sensible at y<sup>e</sup> Sides all over, and by animalls here and there, If wee suppose them to have organs Capable of being Imprest by such a force. That this is So May be proved thus. let a cisterne be filled with water, and a small vent In any Side Made Near y<sup>e</sup> bottom, at w<sup>ch</sup> y<sup>e</sup> water is lett pass, In the parabola of its falling. Strike y<sup>e</sup> Surface with a Batle-door, and at the Same time, the parabola of water falling Shall be Extended. This Speaks the force of y<sup>e</sup> Stroke by Continuity of Matter to Extend by Right lines Every way & In an Instant ([...?] almost) of time. And that is y<sup>e</sup> Same whither there be a foramen or Not. but such Motions are Not Sensible, but when Way is Made for them to pass. And Such are the organs of Sence; for If the  
organ

A.

Organ doe Not yeild to the Stroke, there is No sensatio[n]  
 On any Case, becaus It is an alteration yt makes ye Sensation.  
 This is that, w<sup>ch</sup> Shaddow's to us what light.

And I may argue ye Shaddow Into a Substance, and Say  
 It must be the thing, and Nature hath Not in store  
 any other Mean's, of causing such [s?]phainomena as  
 light is. The Gross case of that is, the passing & Repassing  
 from Every luminary, Every way, at ye Same time and  
 So Continually without Confusion, or contradiction w<sup>ch</sup>  
 were utterly Impossible to happen by any corporeal emis=  
 sary's, whereas thus It is /practicable & \ manifestly Easy to be under  
 stood. as Suppose 2. or 20000, foramina, Each stroke  
 hath Effect on all. so 2. or 20000, strokes at ye Same time  
 Each having Its Influence apart & Conveyed by Strait lines  
 to Each point of ye sides. without Confusion or Iter. And how  
 Ever I State this action In a Cisterne, It may be Imagine[d]  
 that It were a pool; Nay ye Sea it Self, ffor force hath  
 No limits In acting, and ye difference is Not in thing  
 but Quantum. So as, supposing ye Subtlety of a Creatures  
 sence to Inceas, as distance [off?] ye Stroke, or Extent of ye  
 Medium Increases, the Influence runs to Infinite.

Now Compare this with the generall phonomenon of  
 light.

1. the Influence is of lights Quaquaversum, so as ye  
 power of one stroke cross ye direction of Every other, is  
 without Confusion, of each other, w<sup>ch</sup> by bodily Emanation  
 is Impossible.

2. The directions are by strait lines; ffor however ye  
 part's of ye Medium are Irregular, yet united in a  
 vessell (as wee suppose) they are as a solid; whose  
 part's by Every stroke are protruded in Right lines.

It is observable, that the action of light differs from sound in this; sound is by the grosser air, working on y<sup>e</sup> more Etheriall. but light is on the Etheriall Working on y<sup>e</sup> Grosser. As to sound it is Manifest as by the discours of sounds hath bin Evinc't. Then as to light, w<sup>ch</sup> is Now to be Shewed, wee have to consider, that all bodys originally luminous are ffire, in some degree or other. ffor wee must allow a lower degree of fire, as In ordinary Corruptions, w<sup>ch</sup> makes a light as faint; It is Not Needfull all fire must tear flesh so as to make us Sensible. these apart, wee take all other original luminary's to be fire, as y<sup>e</sup> sun, fixt starrs conflagrations candles. &c. And the action of fire Manifestly ly's, In the minuter matter, as Coming from it, & the Grosser, gives way In consequence. wee See a Coal y<sup>t</sup> shall be of a light fire, & Emitt subtile vapour, & [tenuious?] fume. while the formes of y<sup>e</sup> Grosser part's are not disturbed, this is Most visib perceptible in Making Charcoal. where Ever straw and hair among it, shall hold its forme, tho chark't, as well as y<sup>e</sup> wood. w<sup>ch</sup> Shews y<sup>e</sup> action hath layn In y<sup>e</sup> finer Matter, and came to y<sup>e</sup> Grosser but Gradually. and being Extinguisht before that process finished, the coal Remaines. Hence I observe, that fire operates first on y<sup>e</sup> Subtiler Matter; as most agile, & perhaps of shapes fit to be wrought upon. w<sup>ch</sup> I might dispute farther, but Suppose it is or May be done Elsewhere.

But one thing Must be Remembred of fire in generall. that it is Not luminous, unless it be actuated to a degree of strength, Sufficent to thro off y<sup>e</sup> atmosphere. And therefore, smook heat up to flame, Excludes y<sup>e</sup> atmosphere, as also fire coals & red hot Iron, whereby y<sup>e</sup> presence of y<sup>e</sup> atmosphere, lys upon it: And then /action on\ the Reaction of y<sup>e</sup>.

of y<sup>e</sup> fewel, bears upon y<sup>e</sup> atmosphere, as well as strikes upon the ~~surf~~ ~~Inter~~ Interstitiall Matter in it; for If the weight or Spring of y<sup>e</sup> air crouds y<sup>e</sup> flame, the flame strikes that. w<sup>ch</sup> is done by very minute parts, & so propagated quaquaversum. for Instance. In y<sup>e</sup> taper A. the Minute part B. strikes a Minute part of y<sup>e</sup> air or Medium C.D.E. w<sup>ch</sup> (according to y<sup>e</sup> supposed Irregularity of Minute body's) disperseth the ~~aetion~~ /Influences\ Every way as. to. C. D. & E. &c. the same I say of this one part [rt?] Is to be say'd, of Every other part of y<sup>e</sup> taper. A. and the light is the Sume of the Influences from the strokes of all the parts w<sup>ch</sup> Make a generall Influence by light lines from the luminary Every Way.

Here the Influence Comes from the Subtile upon y<sup>e</sup> Grosser parts, as In Sound the Contrary. There is a late Experiment w<sup>ch</sup> Much Confirms this conceipt. w<sup>ch</sup> is the Rising of y<sup>e</sup> Mercury In the pendant barometer. And that they Say Striking the top, as it will, with Great violence; casts a corruscation-sort of light. W<sup>ch</sup> Cannot be but by driving y<sup>e</sup> Subtiler air, faster then it Can permeate y<sup>e</sup> Glass, and so is put upon a Spring, & strikes y<sup>e</sup> outward air with a force sufficient for that porpose. I guess that Glass is more Easily permeable, then y<sup>e</sup> body of Quicksilver This May be Shadowed by a Wind Gun; ffor one smot with y<sup>e</sup> bullet, feels y<sup>e</sup> Effect of y<sup>e</sup> pressure of y<sup>e</sup> subtile Matter, rushing from y<sup>e</sup> derelicted Space, upon the /whole body of\ air; ~~without~~ that is the finer matter upon y<sup>e</sup> Grosser.

1 obj. that So Small an Influence as the strokes of Subtile matter, cannot make such a motion, ~~ex-press~~ In a Grand Sphear, as to Instance the orbis Major, & farther, as wee know is perceptible, In ye Shape of the Sunn's light.

Ans<sup>r</sup>. No argum<sup>t</sup> can be concluded a Minimo;<sup>199</sup> while it is any thing, according to o<sup>r</sup> Maxime (ye least thing moves ye Greatest,) It may be sensible, for If wee bring downe ye capacity of ye organ, w<sup>ch</sup> hath degrees also ad Infinitum wee come to any proportion, and consequently what is Suf= ficient for that porpose.

~~2-obj.~~ But the Influence is Not so slight, but More or less according to ye Sume of ye luminary, and ye Nature of the fire. and as to this latter, I need onely Note, how much more luminous an Exasperated fire is then one dull; both are perceptible, but with strength according to ye Ardency. but for ye other, a perpettuall succession of many, small strokes, /are\ equipollent, to slower & stronger. vis unita fortior.<sup>200</sup> Since ye force of No small part, how Slight so Ever it is, is lost, but hath its Effect ad Infinitum the what is ye Sume of all the strokes from such parts, on ye Surface of ye Sun? Surely Enough to Make an Influence thro ye Whole sphere. Wee know ye light of a candle, will (according to M<sup>r</sup>. Newton) fill an orb of a mile. I may say In Equisite calme & darkness, double that Extent; W<sup>ch</sup> I am bold to Say, cannot be other than such percussion upon the Medium; then take ye Magnitude of ye Sun proportionably, & ye ~~Effect~~ of light from it, is No Miracle.

Note here I doe Not take the Cartesian, Conatus, being onely ye Recess from ye ~~Ear<sup>t</sup>~~ center of ye motion. to be any caus of light, but of Gravitation, or the see [secerning?] of body in fluids, some to & other's from ye center. but this other action w<sup>ch</sup> is comon to all fyery substances

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<sup>199</sup> i.e., 'to the least', refering in abbreviated form to the logic term '*a minimo ad maximum*', i.e., arguing from the least to the greatest, from the small to the large.

<sup>200</sup> i.e., 'forces united are stronger'





Notes on Reading M<sup>r</sup> Newtons opticks

Here as In his Astronomy, he bring in his Dogmata, w<sup>ch</sup> are Extraordinary In y<sup>e</sup> way of phisicks, and so Much counter to the Received opinions In that learning I Can= not but Mark them out for Judgm<sup>t</sup>.

1. In generall I find a continued designe of Depretia= ting of cartesius. ffor his Astronomy seem's calculated to prove y<sup>e</sup> planets Movem<sup>t</sup> in vacuo, and the vorticall movem<sup>t</sup> of the Etheriall matter Inapt to direct their motions. And In this he conteinues his Notion's of vacuum and Colours, for w<sup>ch</sup> later, there may be reason, however he is y<sup>e</sup> solver of y<sup>e</sup> Rainbow, tho in that he makes him plagiary, of Ant, de dominis;<sup>201</sup> a sorry tutor for Such a philosofer. So for his thought of continuity, and Indeed batter's all y<sup>e</sup> Systeme called y<sup>e</sup> Mechanicall. And In no place, gives him any credit.

2. He seem's to designe an overthrow of all Naturall philosophy, and to Reduce it from Inquiry Into the Me= chanicall texture, & law's of things, to some Granted principles, as attraction, Repulsion, & y<sup>e</sup> like, upon w<sup>ch</sup> he may Exercise his Excellent Skill in Geometry & fluxions. one would thinck that philosophy were bewitched, so that when one sifted & Made clean it Must be Mingled againe with its chaff and Straw. or rather that there is More vanity then sincerity In the great geniuses of all ages; and No one will be Contented without being a sole Inventor of all, w<sup>ch</sup> Inclines them to a Spirit of Contradiction, and under the Influence of that so farr, from, carrying on y<sup>e</sup> discovery's of others, and  
building

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<sup>201</sup> Marco Antonio de Dominis (1560-1624)



building on them as on so Much Ground Gained, they  
 study more to Confute then add of their owne, altho  
 the matters are in Many things most reasonable,  
 and If any guesses or Expressions are open to cavill  
 be sure to peck there. If M<sup>r</sup>. Newton had Erected a better  
 sceme of his owne then had gone before him, wee had  
 approved his designing to pull downe y<sup>e</sup> former. but like  
 a second Aristotle, he overturnes the learning of the  
 Ancient Naturalist's, whom now y<sup>e</sup> World allows to have  
 bin in a better way then himself, and sets up Qualitys  
 & Quidditys In y<sup>e</sup> Room, & What doth M<sup>r</sup> Newton doe  
 other, ~~then~~ sett/ing\ up his powers attractive, dispersive  
 centripetall & centryfugall, & I know Not what, /w<sup>th</sup>,\ w<sup>ch</sup>  
 he supposeth matter Specifically & variously possest  
 and to work with as /all like\ living creatures, loving and hating  
 as appetite Move's; This I thinck is to overturne all Na=  
 turall knowledg, or to Make it childish & [confem=  
 tible?]. as If you ask why y<sup>e</sup> Needle Comes to y<sup>e</sup> Magnet,  
 ans<sup>r</sup>. y<sup>e</sup> Magnet hath an attractive power. Why doe  
 heavy thing's goe /to & light things\ from the center, &c. ans<sup>r</sup>. becaus bo=  
 dy's draw one and other. Why doth aire rarifie? ans,  
 becaus the part's have an aversion, & avoid one=  
 & other. why doe /Some\ chemicall Spirits act & Influence  
 ans<sup>r</sup>. becaus they love Not one and other, and will Not  
 as birds of a different feather, be kept in one Cage.  
 and y<sup>e</sup> like, as may passingly be observed In his opticks.  
 Where by y<sup>e</sup> way, he hath cramed in his dogmata; as  
 desiring to possess y<sup>e</sup> world, but Not to take y<sup>e</sup> paines to  
 forme a Systeme, wisely knowing y<sup>e</sup> Method Will Not bear it.



3. It is hard to guess at a Man's Mind, but I, with Re= verence to M<sup>r</sup>. Newton, beleeeve his is, In his attempts of this kind pious. he Must be allowed a prodigy of good Sence, and clearness of thought; but yet ~~to labour~~ In Many Subjects, w<sup>ch</sup> fall Not in y<sup>e</sup> pale of Geometry, to labour under Some p<sup>r</sup>judices of Education. And particulary In the Case of Cartesius filosofy; he Entered Into his Studys, when that Entered Into y<sup>e</sup> World. And It is well knowne how y<sup>e</sup> Academy's Received it, Scarce other wise then as herisy, or antichrist, and y<sup>e</sup> Men of Severer Mood, a= mong whom M<sup>r</sup>. Newton May be placed, batted it with all their Might, scarce permitting student's to Read In it. I fancy at that time M<sup>r</sup>. Newton Embraced a porpose, to confute Cartesius, and bent all his Study's that way, and so, as Many doe, studyed himself Into opinions, w<sup>ch</sup> he would Not have taken up in other termes. And If he, as others pointed at, thought that Cartesius filosofy was Injurious to Religion In generall, as tending to Atheisme; I doe Not blame his christianity & Morality In seeking to overturne it. And If by his ad= mirable analitick genius, hath given him a credit in y<sup>e</sup> World, as aristotle had, ~~he coul~~ Sufficent to found a Sect, and bear downe, what he pleased by /dint of\ Such authority, he could Not better imploy it then In Such a Caus; and I Scarce think any man In Europe More Competent then himself for Compassing such a designe. But the failing, If any, is In thincking at this time of day to Impose on y<sup>e</sup> World, who will search all chanel[s]

of



philosophy, & be their owne Judges; What Els Means Nullius  
 In verba.<sup>202</sup> And Nothing will ~~step~~ /chang\ the Inquisitive & Censo=  
 riall disposition of Men. perhaps accident, as befell  
 Aristotles works, upon y<sup>e</sup> ~~Revi~~all revivall of lerning May  
 give, as there, a p<sup>r</sup>possession, with a corrupt politick  
 aiding, but the literati will In time Early or late, break  
 thro all p<sup>r</sup>judice what Ever. And So happened to Aristotles  
 philosophy of Dreams, till y<sup>e</sup> age of those awake vigilant  
 Heros, Copernicus, Gassendy, Bacon, Galileo,<sup>203</sup> & In the  
 [.] Rere Cartesius, Wherefore it is My opinion that, If  
 there are Methods of philosophy w<sup>ch</sup> ultimate Intens thin=  
 king will Establish, as I tak the Generall cast of the  
 Mechanicall philosophy to Include, It is better to Expose  
 and Imploy it, to pious and Morall porposes. And I am  
 of opinion that Much More such use may be made of  
 the hipothesis of plenitude, then of M<sup>r</sup> Newtons vacuity.  
 but of that Elsewhere. And whither I have a right Notion  
 of this Author or Not, Must appear, by the unfolding some  
 of his opinions, or suggestions.

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<sup>202</sup> *Nullius in verba*, i.e., 'take nobody's word for it' (Horace, *Epistles*, I:14) the motto of the Royal Society.

<sup>203</sup> Francis Bacon, (1651-1626), stateman, philosopher and scientist. Galileo Galilei (1564-1642), mathematician, scientist and philosopher.





4. That Refraction shew's up Coleurs & light in a Manner somewhat different from Reflection may happen from hence. the Influence ~~is~~ /by way of Reflection is\ free to pass to & from all part's of a superficies; but onely by way of Refraction must pass from all part's of y<sup>e</sup> ~~lum~~ force/ing\ or luminous body, In at certein holes or Entrances, & then be mixed In another manner. W<sup>ch</sup> May be y<sup>e</sup> reason y<sup>t</sup> Rainebow <diagram, crossed out> colours appear at y<sup>e</sup> Edges of all Refracted light; It is probable, that a certein Mixture of this Influentiall force, wee call light, May caus in our sence The variety of colours. ffor If there may be such changes In y<sup>e</sup> mode of light coming the Image ~~is~~ Made in our Sence is /Indeed\ owing to it as ~~the~~ an occasion, but is formed in our conception; & is Not in the object. as hath bin Shewed, therefore to ans<sup>r</sup> all the variety's brought to us by light, it is enough to shew, there are ~~so~~ Numberless changes In y<sup>e</sup> Modes of ~~y<sup>e</sup> caus or occasion~~ that Influence; ffor as cartesius once observed, No reason can be given, why that w<sup>ch</sup> wee call blew, is Not to us Redd, or y<sup>e</sup> Contrary, but that our Nature makes it so. goe to y<sup>e</sup> object and you find onely materialls actuated in different Manners, w<sup>ch</sup> produce different Ideas. as various strokes on y<sup>e</sup> body caus. different paines, y<sup>e</sup> Ideas of w<sup>ch</sup> are Not In y<sup>e</sup> battoon, /& moving of\ w<sup>ch</sup> occasion them, but In our braines or sensation; the like I affirme of Colours, w<sup>ch</sup> In o<sup>r</sup> Sence have variety, as y<sup>e</sup> modes of y<sup>e</sup> Influence that caus them vary.

There are 2. things in M<sup>r</sup> N<sup>s</sup>. opticks very Remarkable  
 1. that the rainbow Colours are Not altered by any Refraction, but once formed are so thro all Refractions,  
 from

from whence he Inferr's, that colours (or their Nature) sub=  
sist in light and are onely separable by Refraction, accor  
ding to their different Refrangibility's. This wee that Make  
all light however Modyfyed, and perceived by us, to be  
the Influence of y<sup>e</sup> Medium, or Some order or part of it.  
cannot allow. but assigne the Refrangibility, as he  
calls it) or distinction of colour to the body thro w<sup>ch</sup>  
the Influence passeth, & Not to the Influence it self.  
And wee allow that however light is modified so, as to  
p<sup>r</sup>esent to o<sup>r</sup> Sence any Colour, no refraction shall make it  
Rep<sup>r</sup>esent any other colour; becaus the same mixture  
of y<sup>e</sup> Influence goes on thro all ~~Reflections~~ Refractions  
but Whither that colour after a Second Refraction  
be Not otherwise modyfyed then at first, that is by  
some lines or distinctions tho faint, Experiment mus[t?]  
shew. light is Self is comonly tinted with colour, as When

Wee have Not Hitherto dwelt upon any mixture of Impuls & attracts, but conceived them simply such. that is when the body Impelled ly's all In [a?] sphe hemisphear of ye Effect, and when attracted, all in that of the force; but when part of ye body fals in ye one and part in ye other, It a fforce may work partly as Impuls & partly as attracted as.

**fig. 15.3.** As If ye Sphear be Impelled at K. so as K.W. is ye plan, the segment K. & O. [R.?] W. lying In ye /hemi\sphear of ye force is attracted, & ye others Im K. A. T. B. W. In the hemisphear of ye Effect is Impelled.

And Now wee are to consider If much difference may happen peculiar to this mixture.

1.

In case of Impuls, It may happen that the plan May be any as can possibly cutt the point of Contact as. The Sphear is Impelled at [E.?] ordinarily K.[a.?] ye tangent is ye plan. but by reason of Inconsiderable Excavation's or prominence's; In ye Surface ye force may fall so as [Q?].K. or any other plan as Q T. Q.z.: &c may be ye plan of ye force. And If wee Suppose ye point of Contact to have demension. to this porpose, but Next None, it is No strain but agreeable to ye practise of thing's, In w<sup>ch</sup> small

things are slight.

2.

However the plan falls, [...?] a [diametrall plan?] of ye body p[ara=?] lell to it. As If the plan of ye fo[rce?] upon Q. be Q.K. then A.B. is [...?] diametrall plan,

3.

If the plan of the force and the diametrall plan are Coincident, that Impuls or attract is In Extream obliquity, that is Gives all turning & No progression. as If a force falls upon A. to as A.B. is both the plan of ye force, & ye diametrall plan, whither ye force comes from E. by Im= puls, or from p. by attract, all ye Event is turning.

4.

A force may /be supposed to\ ffall upon an Exte= rior or upon an Interior point of a body. ~~ffre~~ If it /later\ be denied, I say a small foramen may let in ye force, Therefore what is possible Naturally, May be supposed, as let the point D. be within ye Sphear, I Say a force from Q. or K. /or E. &c\ may ffall upon it, ~~and it is by~~ and [that?] by ye Capillary foramina Q.D. [this?] or E.D. And If Gravitation be as [may?] thinck Impuls on ye Interior part's of ~~matter~~ /porous bodys\ as well as the Exterior, the thing is [continually?] acted.

<sup>204</sup> The following two sheets (ff. 189-90) are folded vertically and written upon in two equal columns. Much darkening and bad wear around the edges and at the top, especially on this, the first page. Also the paper has proved very porous to ink and writing on one side of the sheet shows up on the other making transcription difficult.

5.

[...?] of force falling on y<sup>e</sup> Surface  
 [...?] body as at. K. ~~the~~ with K.W.  
 [...?] plan. The part attracted, vist<sup>t</sup>.  
 [...?] segment K.O.W. doth not  
 [...?] the generall rule of Impulses,  
 out the progression of y<sup>e</sup> center  
 Shall be by a line from y<sup>e</sup> contact  
 vist<sup>t</sup>. K. X.

ffor If the segment K.O.W. were  
 away the center alters, and whereas  
 In y<sup>e</sup> Intire sphear it is at. c. that  
 part /K.O. Q R\ absconded it will Remove  
 towards. T. ffor The force /of y<sup>e</sup> Segment\  
 acts

as  
 Quantity by way of Impediment  
 and the manner of its. position gives  
 the value. as here it is posited so  
 as to be y<sup>e</sup> complement of the  
 Sphear, as here y<sup>e</sup> conjunction be=  
 ing In y<sup>e</sup> plan K.W. the applicat=  
 tion is y<sup>e</sup> Same as if it were at  
 [y<sup>e</sup>?] center of y<sup>e</sup> plan. Y. and then  
 whatever shape the segment  
 K.O.W. were put in it were y<sup>e</sup>  
 same thing. as If it made a Sphear  
 of it we self and were attacht  
 at. Y.

But If that /lesser Globall\  
 sphear, were m  
 attacht to any other point of y<sup>e</sup>  
 plan, then it made a difference  
 for It amounted to so Much  
 matter more Irregularly. plac't. &  
 so as the center of y<sup>e</sup> connexion  
 wer in y<sup>t</sup> point, where wee sup=  
 pose it attacht. ~~And that~~

As let that [...?] ...?  
 be plac't /Not\  
 at Y. but at [W?]. it  
 wou[ld?]  
 then draw the center (w<sup>ch</sup> poi[nt?]  
 is to be Indifferently plac't as to  
 the whole) more that way, an[d?]  
 doth but make y<sup>e</sup> Impuls more  
 Obliq, then when it made up y<sup>e</sup>  
 whole Globe Intire.

And this will be y<sup>e</sup> Case of all  
 strokes whose plan /of y<sup>e</sup> force K.W.\ and  
 diametra[ll?]  
 plan A.B. are paralell.

6.

But<sup>205</sup>

Ergo, the attracted part doth  
 Not alter the rule of direction  
 w<sup>ch</sup> is universall, If y<sup>e</sup> Impuls be  
 taken on y<sup>e</sup> Same side of the di[=]  
 ametrall plan. A.B. and as to  
 that. of Observe

6.

That the diametrall plan A.B.  
 devides the account between Im[=]  
 puls & attraction. ffor if y<sup>e</sup> force  
 touches on y<sup>e</sup> other side of y<sup>e</sup> dia=  
 meter. AQ. as at. Z. & T. &c it  
 is attraction. and also mixt with  
 Impuls. as If y<sup>e</sup> force falls at Z.  
 from about K. and Z. X. is y<sup>e</sup>  
 plan. so at T. & T w. id y<sup>e</sup> plan  
 The segments Z.N.X. and T.N.[w?].  
 are Impelled. the Rest of y<sup>e</sup> body  
 attracted. And with like reason  
 as before the attracted parts did

Not vary y<sup>e</sup> Rule of Impuls as direction, when y<sup>e</sup> force was on y<sup>e</sup> [si?]de of y<sup>e</sup> diameter towards. O. so [t?]here it being towards N. it doth Not alter the rule of direction upon the attraction. but Notwith= standing In these Impulses, that have plan's paralell to y<sup>e</sup> diameter A.B. there be a mixture, whither the force fals on y<sup>e</sup> one side or on y<sup>e</sup> other. yet the property's of Im= puls that is direction In a line from y<sup>e</sup> Contact towards O. and that of attraction, ~~weh~~ is as I am to ob= serve on y<sup>e</sup> other.

7.

If the force works In the hemis= phear of y<sup>e</sup> force by way of attract and Not Impuls, ~~If the line of the~~ /having the same\  
[at]tract be /plan\ the effect is In Every [R]espect y<sup>e</sup> Same.

as If the point Q. be attract by y<sup>e</sup> line T.Q. so as y<sup>e</sup> plan is Q.K. The effect is y<sup>e</sup> Same, as an Impuls [o]n Q. what Ever part it Comes [f]rom. so as Q:R. be y<sup>e</sup> plan.

It will be so admitted If the Impuls [c?]ame from ~~æ~~. the line of attract [c]ontinued. and Every obliquity of [Im]puls hath the same effect on y<sup>e</sup> body Impelled by y<sup>e</sup> force of the [strok?] onely Excepted.

An Impuls In the hemis[phear?] of y<sup>e</sup> Effect, hath the [same?] operation as an attract upon y<sup>e</sup> Same point, If y<sup>e</sup> plan In both be y<sup>e</sup> same.

as If the Impuls be on T. y<sup>e</sup> plan being. T.[w?]. ~~It is~~ the /efficacy is\  
y<sup>e</sup> same, as from an attract by y<sup>e</sup> line l.T.

This is Reasoned as the former Hence Impuls & attraction by y<sup>e</sup> same point with y<sup>e</sup> same plan is of the [9?] same Efficacy.

Here the diagram is a sphear but the same measures hold In all cases of Irregular bodys, for substraction or addition of matter so as to deforme [the?] Sphears, together with the [con=?] forming of y<sup>e</sup> center's place makes the account Exactly y<sup>e</sup> same. ffor Whatever is argued ffrom y<sup>e</sup> addition or substraction, however it is made, I answer by shewing the center accor= dingly removed;

Impulses or attracts  
on Interne points.

If the Impuls or attract be so  
as the diameter & y<sup>e</sup> plan. A.B.  
[be?] y<sup>e</sup> same. by bringing y<sup>e</sup> force  
[Next?] the center, the [...ing?]  
[..lines?] and progression Grows  
In y<sup>e</sup> proportion of Cubes, decrea=  
Sing.

let y<sup>e</sup> force be at H. I say  
[... pro?] Turning Shall be less  
[...?] cube/ H.C. to cube A/C\ H.  
for A.C. Exposeth the whole  
turning force, and H. C. that  
w<sup>ch</sup> there is Effectuall.

The reason is If the orb. H.A.  
[...?] away. and The Globe /HO\ re=  
[mai?]ned subject to the force at  
[H.?] the motion of that Residue  
would be all turning. then the  
orb, H.A. is So Much Impedim<sup>t</sup>.

(As /on\ H.C. /on\ A.C. - /on\ H.C.  
(so is The Turning /at H\ to the  
whole turning /If y<sup>e</sup> Stroke were\ at A.

And that is according to Quantity  
w<sup>ch</sup> fall is that proportion, for  
Sphears & segments are as the  
diameters, & segments of y<sup>e</sup> dia=  
meters.

Suppose the eircle sphear, to deg=  
generate Into an Ovall, & so Cont=  
nually, A.B. continuing the lon=  
gest diameter, till y<sup>e</sup> ovall is Eva=  
nescent In that diameter, A.B.  
~~then~~ and y<sup>e</sup> is Next to a  
strait line. then the force of tur=  
ning is as the segments of the  
Diameter.

That is the Turning at H.  
is less then that at A. as H.C.  
to A.C. or a force p<sup>r</sup>sumed In  
Equality, or stoppable at A. Shall  
Reflect, at H. as /becaus\ so Much less  
Efficacies as to y<sup>e</sup> turning; and  
a progression demands Greater  
force to Equall it then turning.  
ffor y<sup>e</sup> Sustance Increaseth as y<sup>e</sup> Segments.

A stroke /force\ upon /some Intermediate  
point of\ the diameter  
Shall Give a progression of y<sup>e</sup> Cen=  
ter, as well as turning. what =  
ever forme y<sup>e</sup> body hath.

ffor all that is Impedim<sup>t</sup> to  
Turning, Is active to progression,  
for ~~Quantity will~~ /y<sup>e</sup> Substance must\ yeild to  
y<sup>e</sup> force  
one way or other; according to  
y<sup>e</sup> rules before shewed. And If there  
be No turning at all, y<sup>e</sup> body Shall  
have progression

praefaces,

Science.

Intending to discours of Natural things and their causes, whereof the science, among the Ancients was termed phisicks, My first Essay shall be In generall of science itself.

And It is but a Mentall application of Experiences, as there is occasion, ffor supplying certein defect's In humane Capacity. All our notice of thing's in the world, Is by y<sup>e</sup> means of Images Imprest upon our organ's of sence, W<sup>ch</sup> Impressions are to knowledg, as pictures are to the thing's represented by them. And take from sence all Experience, No creature can pretend to know any thing 'truly, tho It be the caus of the sensation. ffor what appears small may truely be great, and the Contrary, so here & there, this or that, all are uncertein to Meer sensation.

However this is as comon Notion', among  
such

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<sup>206</sup> The following sheets (up to and including f. 194) have been re-numbered, the older BM numbering (ff. 165-8) having been struck out (in pencil).



## prefaces.

## Science

such as thinck philosophically, yet I shall, for clearness sake, shew it In In=stances. An hous or a tree, when distant is to y<sup>e</sup> sight a very small thing, w<sup>ch</sup> collated with y<sup>e</sup> sensitive creature (the Comon measure of Magnitudes) is an Im= mens thing. Then as to place, sence tells us, that Images are In a lookingglass, w<sup>ch</sup> are truely on y<sup>e</sup> avers part of us. but this is an Instance not of that sim= plicity, as this place Requires. ffor It is from Experienc, that wee determine of place.

## Science

## 1.

Intending to treat ~~Scientifically, as I may, about~~ /of\  
 Naturall thing's, my ffirst Essay is of science it  
 self; ~~And that~~ /w<sup>ch</sup>\ in generall, is The /a mentall\ application of  
 Experiences, ~~layd up in y<sup>e</sup> Memory, so as best may~~ /for Supplying\  
~~supply~~ certein defects In /of\ humane capacity. ffor Im=  
 mediate Sensation ~~Informes~~ /gives\ onely /some lineaments or\ ~~Some fforme~~ /Shapes\  
 /as a picture, w<sup>ch</sup> hath nothing of the thing Represented in it, ~~whereby by~~ [sen?] so\ but  
 little or Nothing of the truth of things ~~perceived~~  
 /comes to us by the Immediate perception\ but that is Gathered from Experience /by help of  
 memory and argumentation\; ~~And Experience~~  
 /this usefull Experience ~~in par~~ Relating to particulars\ is a Stock of memoirs of various  
 modes in the Sen=  
 Sation of one thing /and y<sup>e</sup> same [falls?]\ as May be at /happen at\ divers times, ~~divers~~  
 distances, ~~by divers~~ [rules?] /posture\, & y<sup>e</sup> like,\*<sup>207</sup> w<sup>ch</sup> layd together  
 In y<sup>e</sup> Mingd y<sup>g</sup>ive a truer account of that thing then  
 any one sentsation can, w<sup>ch</sup> to doe Well and Readily  
 is y<sup>e</sup> Work of science. /But in church or a gallery, ~~becomes less~~ appears to grow less, bur  
 walking to y<sup>e</sup> other End, y<sup>e</sup> tables are turned, & y<sup>t</sup> w<sup>ch</sup> was widest seem less\<sup>208</sup>

I distinguish therefore Science Into ordinary & Extra=  
 ordinary.

1. The ordinary is that whereby men Come to know  
 the truth of things they are dayly Conversant with;  
 and differs from y<sup>e</sup> Extraordinary onely /in\ this that  
 the ordinary cours of life teacheth ~~This, and~~ /y<sup>e</sup> former one [but?]\ y<sup>e</sup>  
 other is Not learnt /had\ without particular /Especiall\ application,  
 of /observation\ Study & /&\ practis, but ~~y<sup>e</sup> one and other~~ /both\ are Equally /merly\  
 y<sup>e</sup> application of Experience.

~~It is an ordinary Skill /for a man\,~~ when 2. trees appear in  
 view one larg & distinct, y<sup>e</sup> other Small & Confused,  
~~for a man~~ /a Country man has skill Enough\ to declare the former is neer; & y<sup>e</sup> other  
 ffarr off. becaus he hath often sviewed y<sup>e</sup> like, and /upon aproach\  
 /to both\ by Imediate sence, found the truth to be so; and thence  
 he argues y<sup>e</sup> like In all cases of like appearance; and

<sup>207</sup> RN has an asterisk here which appears to refer to a crossed-out marginalia now covered by the binding: '[stet?] ---.---?'. As far as I can see, the two-word comment is struck out, but, whatever it was, has been restored by the 'stet'.

<sup>208</sup> This addition is partly crossed-out with hatched lines.

And by this skill it is that wee know the hollownesse  
 & distances, and Judg of y<sup>e</sup> places & scituations of  
 all things In landscape. There are ffew Sensations  
 of things, w<sup>ch</sup> In themselves /as to knowledg\ are Not thus Imper=  
 fect, and /but\ being ~~so~~ /thus in comon Education\ Regulated, become as Comon  
 sence Even to y<sup>e</sup> plainest people. The conceipts of  
 children demonstrate this, who carryed in a Coach, from  
 the parallax of y<sup>e</sup> trees, pronounce them to Move and  
 pass by one & other; those of more Experience know they  
 all stand /still\, and the moving of their person's onely creates  
 that appearance. And ~~yet the generality of~~ /to say truth wee know all\ the parts  
 & members of our body's by y<sup>e</sup> Same means, as when  
 a touch is on y<sup>e</sup> hand side or Shoulder, & y<sup>e</sup> like.  
 but yet y<sup>e</sup> generality of men are so ungratefull  
 to Experience, that all this knowledg is ascribed  
 to pure sensation, for w<sup>ch</sup>, the sequell may give a reason.

This application of Experience to comon sensations  
 is /ordinarily\ done without a direct thought, or Intention that way,  
 but In a manner Insensibly, as men often Court  
 or avoid thing's without thicking; w<sup>ch</sup> is termed, Na=  
 turally, like winking at an assault; ffor our action's  
 as well as opinion's are often moved without any  
 concurrence of y<sup>e</sup> attention or will. And therefore it is  
 wee seldome know by what stepps or mean's wee are  
 Informed, but acquisce In opinion, by what chance  
 soever It is Informed.

In truth, scarce any thing is thro Sence perceived  
 but y<sup>e</sup> Mind Instantly ~~apply's~~ for better adjusting the  
 matter, applyes Some Experiences to it: Sometimes  
 the

the Experience is full, & clear, as Seeing a live horses head, there must needs be a body belonging to it, tho, from Some [Coverture?], unseen; then there is No suspens but ye Mind is at Eas. But If any Novelty appear, then ye Memory is pumped for likenesses, to be applyed, ~~this is~~ /to disco\ ver if that be any of them. w<sup>ch</sup> is doubt & consideration. but If ye Novelty be without Example and Great, the consequence is admiration, & litle Els, And such cases are void of all manner of Science.

It must not be understood here, y<sup>t</sup> the sence is fals, and not to be Rely'd on, becaus knowledg comes from another root, that is, comparison of divers sensations. ffor now ye world is agreed, that the organ delvers ye first Idea /of\ y<sup>t</sup> action y<sup>e</sup> /w<sup>ch</sup>\ falls upon it from ye object ~~deline=ates,~~ and swerves not at all. ~~But onely~~ /ffor in ye Same\ post it is allwais the same, w<sup>ch</sup> shews a constancey, y<sup>t</sup> ~~allwais~~ Ever attends truth. but It is Neither ye whole, not free from accident In ye passage; and when ye Mind ~~p<sup>re</sup>ecipitate~~ p<sup>re</sup>cipitously determines so half peversly Informed, ye Error is In ye Judgm<sup>t</sup> & Not in ye Sence. so It was In ye Case of Distance, w<sup>ch</sup> deminisheth objects, and views by Reflection shews a fals place; all w<sup>ch</sup> are In ye manner of ye action Coming, & Not In ye organ that Receivs it, and /when it is so\ ye Mind Errs for want of application of Experiments.

Here it May be proper to shew ye laws and Nature of Insanity, or reasoning maddness, w<sup>ch</sup> is ye Revers of ordinary science, and May be called, Error In matters of ordinary sensation. ffor If object's of  
sence

sence are mistaken, and beleaved to be other then they are, w<sup>ch</sup> some times from weakness of faculty's Great frights, corrodind sorrows, ~~or~~ acute feavours, ~~or~~ other Corporall Infirmity /passions\ or accident, happen Most Grossly to possess some persons, and past all power of their Reason to Regulate & Correct. It will appear that ~~Such person's~~ /they\ shall argue very consistent and Rationally on all subject's but those of Inured falsity and there they fall in passion's, rave, or have No Just discours at all. And this doth Not Impeach their Rationall Capacity's at all, ffor admitting those facts, ~~as they are Supposed, and beleaved, to be~~ /w<sup>ch</sup> they so [Invinciby?] beleeve\ and /then\ Even upon them, the discours will be Rationall, and all their Con=sequences true. I have knowne many Instances of this In divers degrees, nay in some so low, and moderate, as to draw No suspicion of Insanity, and y<sup>et</sup> In tanto hath bin y<sup>e</sup> Same, & others In Extremity taken Notice of /as Maddness\ & Referred to Doctors to cure, tho Nullis Medica= bilis herbis.<sup>209</sup> let one comon bedlam Instance suffice w<sup>ch</sup> is of persons fancying they are Kings. then all y<sup>e</sup> Sequel, or usurpation, deposition, distress, & other tragicall Measures used to them are true. And ~~as to the~~ /how [far?]\ /apt\ poor humane nature is ~~capable susceptible of~~ /to Entertein\ Errors ~~or~~ to be Imposed on, or violently Imprest, I leav to those who have considered y<sup>e</sup> Subject & y<sup>e</sup> power of self flattery, p<sup>r</sup>judice, passion, & diseases. And so Much may suffice upon y<sup>e</sup> Subject of ordinary science.

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<sup>209</sup> i.e., 'not by medicinal herbs', invoking '*Hei mihi! quod nullis amor est medicabilis herbis*; Oh me! Love cannot be cured by medicinal herbs) Ovid, *Metamorphosis* I, 523)

2. Extraordinary science, is the same, but higher Refined; as for Instance, y<sup>e</sup> Country man upon view tells w<sup>ch</sup> tree is is neerest, but an artist by his nicer observations & Instruments, compares the distances, and say's how Much y<sup>e</sup> one Exceeds the other, And those onely can do this who have collected /& layd up\ In their minds Some truth's In y<sup>e</sup> way of Geometry. the like Is found In other subjects In y<sup>e</sup> way of humane life; as /Geometry, Astronomy, Musick arithmatick Medicin, Morality, politicks, &c. In w<sup>ch</sup> Some men ~~Impe~~ Employing their /thoughts &\ [Industry?] more then<sup>210</sup> other's have ~~layd-up~~ a stock of collected truths In their memory's, w<sup>ch</sup> are produced and upon occasion applyed and In /w<sup>ch</sup> is\ [this?] Is judgment In such /the\ Sciences as ~~they have~~ so acquired.

Of all those way's of Improving y<sup>e</sup> Mind by Science, I have chose that of Naturall filosofy ffor my diversion as well as study. and my reason ffor it is, that of all other's it is ~~neerest to meer Nature~~ /what Nature leads directly to\, and advanceth /in us\ by continuall degrees /more or less\ ffrom the first opening our Ey's In y<sup>e</sup> world, to the /finall\ closing of them againe. and hath ~~No~~ /so litle\ relation to fraud or profit as scarce Corruptible that way, but is Courted for its owne sake purely, and Returnes to y<sup>e</sup> Mind onely ~~the fruit of~~ /so Much of satisfaction & Repose as /is\ adequate to\ that application y<sup>e</sup> Mind hath /bin bestowed\ Given /upon\ it; ~~that is Satisfaction, & Repose, If Not~~ /And If that succeed Not happily\ in all the Subjects curiosity leads to Inquire Into yet in y<sup>e</sup> principall & more generall /It seldome ffailes to give content\ The curiosity & Experiment begin's In meer Infancy as /appears\ by that strang Inquistiveness of children  
youth

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<sup>210</sup> Here, and in two places on the verso of this sheet, some patches of white paint-like material.

## 6. Science.

youth No less, but acts with a little more vigor and is apt to leave knowledge for the sake of action, which is the Result of spirits & constitution, Middle age is more addicted to Gather knowledge being content with some measure of Rest. and old age hath such value for it, as to be proud and arrogant in a mere opinion of having it which is called authority. And however the men of the world do slight all knowledge that leads not to profit; yet such as have some Indifference towards that, may be allowed to Court the knowledge of Natural truth's; which Even the most busy would Gladly enjoy, and seem to slight because they have it not. lastly this Study not only begins and Ends with us, but in its Course, as auxiliary, takes in a reasonable skill in all other art's whatsoever, so that a profest Naturalist may not without blushing, be absolutely ignorant of any thing. This is Appology for ye bold adventures to be met in the sequel of these papers.

## A short Idea of Sensation

The Efficient Caus of all sensation, is loco Motive force, w<sup>ch</sup> acting Externall upon the bodys of Animalls, alters the position of some of the parts, and that alteration by y<sup>e</sup> artifice of certein M'branaceous connexion derived upon a Comon Resort or concentration of such Influences, supposed to Reside in y<sup>e</sup> brain, becomes obvious to the thinking Capacity to observe And being also attended too, is what wee Call sence. or In a word, sence is the Minds attention to Materiall changes and differences of posture among certein parts In y<sup>e</sup> animall fabrick. I shall touch upon y<sup>e</sup> Consequence of attention or Non-attention afterwards, In y<sup>e</sup> Mean time observe that this description agrees with that manner of faint sensation, w<sup>ch</sup> wee Call Memory. ffor sence gives the various positions or shapes, w<sup>ch</sup> as Impression's on y<sup>e</sup> Same wax, shall Remaine More or less altho divers other's are superinduced, untill y<sup>e</sup> Multitude & complexity of y<sup>e</sup> latter wholly Efface y<sup>e</sup> Earlyer of them. and y<sup>e</sup> Mind by a cours of y<sup>e</sup> attention passing from one to another, as an observer of y<sup>e</sup> wax, hath a notice of y<sup>e</sup> Impressed formes. & knows them (tho perhaps but Just Not Effaced) by their differences, but whither this capacity of distinguishing, w<sup>ch</sup> Implies a Nicer sence of Memory of things in  
some

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<sup>211</sup> The following sheets (up to and including f. 200) have been re-numbered, the older BM numbering (ff. 126-31) having been struck out (in pencil).



Some persons, then in others, be from /a fitness or otherwise\ an Inepti=  
 tude in ye materiall of ye sensorium, as some wax  
 takes Impression's More lively & distinguishable  
 then others, or from any difference of the thin=  
 king capacity, I shall Not p<sup>r</sup>tend to determine;  
 But thus farr it seems plain, that whither all  
 thinking creatures, humane especially have E=  
 quall capacity or Not. If the sensoriall Com=  
 position be stiff, or less plyable to Impression's,  
 The Imagination, or sence of things, & Memory  
 are accordingly dull.

But taking it thus for granted, that all sen=  
 sation is derived from simple touch or pulses  
 ab Extra,<sup>212</sup> The modes & measures of them ~~must be~~,  
 according to the disposition of active matter In  
 the world, Must be quasi Infinitely various, and /consequently\  
 the Images of sence diversified without limit  
 and Cannot Intirely be Either described, or Num=  
 bred. And the rapidity of the attention passing  
 & Repassing from one Impression to another,  
 creates In us an Imagination of Continuance.  
 And all distinction of things, proceeds from a  
 capacity of moving our members. ffor If ye tou=  
 ches, or variety of pulses, whence wee argue some  
 change, that is perceiv, pass swifter then wee Can  
 actually Move some of our members, or w<sup>ch</sup> is  
 ye Same thing Mentally, or from Memory, Suppose  
 it, there is No Idea at all of Continuance, but  
 such Modes of perception are Coallescent, and  
 afford

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<sup>212</sup> i.e., 'from outside'

afford us an Idea of time but not of any distinction in y<sup>e</sup> Ingredients that make it. of w<sup>ch</sup> a word or two afterwards; It shall be Enough here, to Mention an Instance or two of fact, w<sup>ch</sup> Shew this thought to be just; And passing by those ordinary actions wee use to distinguish things, as pointing with y<sup>e</sup> hand, or Nodding y<sup>e</sup> head, I Insist upon Sound, and light, w<sup>ch</sup> are perceived under a Mode of continuation; the latter of these, by certain discoverys, & proofs from Experiment is made appear to be pulsular; and y<sup>e</sup> other by a parity of Reason, depending on y<sup>e</sup> nature & rules of motive force, is argued to be so, But y<sup>e</sup> Subject is not yet so fully discovered, that wee can pronounce so positively, as of y<sup>e</sup> Other.

Considering the unaccountable variety's of sensation's, w<sup>ch</sup> must be diversifyed as y<sup>e</sup> Modes of touch are, and those acting upon Imperceptible minuteness of parts, the combinations of change are beyond y<sup>e</sup> use of Arithmetick to account for therefore there is No dealing with them, but by gross partitions or classes, with subdivisions as there is need and o<sup>r</sup> Capacity will allow us to distinguish; Therefore I Consider, first the things that act, as wood stone, mettall, flesh, furr, &c. whence wee have the diversifyed Ideas of hard soft, smooth, warme, & y<sup>e</sup> like, w<sup>ch</sup> are all but touch, but in Modes so very different, that wee Assigne them denominations, as heads of farther  
distribution

distribution, Into proper species of Either, as the severall sorts of wood, &c. then Next wee consider the parts of ye body upon w<sup>ch</sup> ye action falls; and there wee find the cheif varietyts of touch that at p<sup>r</sup>sent wee are Concerned with. as when a legg, arme, or ye head /&c.\ is touch't, there is a very distinguishable sensation belongs to Each affected part. And it is thro Experience & memory that wee know w<sup>ch</sup>, is w<sup>ch</sup>. fferr ye use of our parts In ye ordinary Exercise of life, from our Nativity, & it May be sooner, Impresseth that knowledg, so as it becomes habituall, & it Requires No Reflection, to determine when it is a ffoot or hand that is touch't. And abstracting this Experience, all touch would be but meer perception, without any knowledg, how or by what agency, or Mean's it Comes; And from hence wee May conclude that all the knowledg wee have of ye World, or any thing in it, or even of our Selves and our Constituent Members, is all but p<sup>r</sup>judice of Experience, by w<sup>ch</sup> wee determine without any Reflection, or thought. This will appear very plain If wee Consider those parts of o<sup>r</sup> bodys that wee cannot Come at, or Examine, as the Stomack, Heart, Lungs, liver, Intestines, &c. wee can say wee feel a pain within, & expect the phisitian should say what part is affected; and He must Recurr to his anatomy, & from thence p<sup>r</sup>tend to guess; And how much D<sup>r</sup>. & patient both are mistaken, divers Inter plures<sup>213</sup> know have ffelt; perhaps Aptitudes may be, as formes, & colours ex[=] traduce, other knowledg Comes Not by Extinct.<sup>214</sup>

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<sup>213</sup> i.e., 'among many'

<sup>214</sup> As opposed to 'instinct' (or intuitive knowledge), 'extinct' would be knowledge that could be learned.

Of Attention, and the great  
Importance of it In ye work of Sence.

Attention is very different from sensation, & greatly depends on our free will; violence of touch will impose on our attention, as well as on our sense; w<sup>ch</sup> most will allow, that have bin acquainted with pain. But In Indifferent cases, It is almost in our power, whither wee will attend, or No; and wee commonly alledg Ignorance of Considerable attacks, saying wee did Not Mind them. But to bring this matter to a Crisis, I think it may be affirmed that In these slight cases, wee have an absolute /power\ of timing our attention; A man may say, I will consider this matter very well, & dwell upon it or I will still observe; or I will think no more on't, and (as thy say) Call another Caus.<sup>215</sup> And So Men use their senses, & Memory's, passing from on object or Reflection to another, sometimes in a wild careless way /If\ attending long upon any matter /it is\ (as it were) by accident, and sometimes carefully & with Intense study. And how much the free will Commands in ye direction of these Continuances of attention, and choice of various Subjects to attend too, Every Man May tell himself.

I touched upon an Idea, whereby to adumbrate the Retention of Sensation's, in o<sup>r</sup> memory's; w<sup>ch</sup> was that of Impression's upon wax, w<sup>ch</sup> Superinduced  
by

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<sup>215</sup> Note the legal image here. The law is the model of unprejudiced attention.

by others over them, are not strait obliterated but by some lineaments Remaining are perceivable; And our thinking faculty is put in y<sup>e</sup> place of the observer of these Impressions, to Note in y<sup>e</sup> Sensorium the vestigia of past sensations, by means of their proper differences. But I must Refine this Image; and it is thus. the observer, is without his object, y<sup>e</sup> Imprest wax, & must perceiv thro all; but the Mind is within, and among y<sup>e</sup> Impressions, upon the Sensorium; and So may pass from one, to another, thro y<sup>e</sup> whole Magazine; and hath Not the whole Number to look thro. as y<sup>e</sup> Case of y<sup>e</sup> observer is. But This act of attention, confined to memoriall Impressions, doth not pass from one thing to another, but as men walk about an hous, not skipping over some rooms, to come at others, but from one to another in Immediate proximity. this is called y<sup>e</sup> chaine of thought. and it may be a rule, that no person thinks of any thing next after any other, if those had Not bin perceived, or thought of together before, and accordingly, a matter frequently in mind, is Easily Recovered; but once or twice onely, very hardly. So when a thing is wanting to be remembred, the attention is lett loos, & passeth in various tracts to & fro, guided by y<sup>e</sup> will to those Judged most Likely to fall in with what is Sought, and when that, by means of some proximity, is Recovered th[en?] y<sup>e</sup> attention fixeth ~~there~~ upon it.

In many Cases there May be perception without any Remembrance; as In Stupid cases; So also in  
all

all Cases where there is No attention, and I may add where there is No governem<sup>t</sup> of the attention, but it is lett loos to pass without Res<sup>t</sup>raint of time, or choice, or In a Word where the Will is not Exerted in any act of its power. and that I take to be the Case of sleep. that power of the mind, to Will any thing, being Quitted, the animall is perfectly asleep; But at y<sup>e</sup> Same time all facultys, Except Willing and timing the attention, or fixing it more or less upon certein Ideas, are in full action & force; Sensation is y<sup>e</sup> Same, but Nothing Remembred; as paine is felt, & Resented in groans, but all Record of it is lost, unless it Engage y<sup>e</sup> attention in some measure, & If Not Intirely, the Result is onely shapeless dreams. ~~that~~ /It Seems\ y<sup>e</sup> Mind (that is y<sup>e</sup> attention) travells its Storehous in sleep, as much as awake, onely with this difference, the latter is held to times & things, but in Sleep /it\ passeth without rule, time or choice; therefore, upon y<sup>e</sup> mind Resuming its willing, w<sup>ch</sup> is waking; the track it ~~takes~~ /is in\ shall /often\ be /found\ so Remote from y<sup>e</sup> p<sup>r</sup>sent state, that all things perceived are amazing, till the acquaintance with y<sup>e</sup> place, &c Sets y<sup>e</sup> attention in tracts Conformable to it.

The mind of man is Single therefore the attention Can be but to one thing, at one time, and that Even in y<sup>e</sup> Most Minute Incidents. But the seemingly Extensive comprehension of things, is onely a Memoriall transition of y<sup>e</sup> attention to & from one thing to another with Inconceivable Celerity. I can shaddow  
 forth

forth this thought No better then by our own faculty of  
 vision, and that seems very much to the porpose.  
 ffor In Opticks it is held that vision is just but to  
 one point; all the Rest is Confusion; and it is a per=  
 transit of y<sup>e</sup> sight from point to point Every way  
 without designe or account, that Makes good So  
 large a visuall angle, as they allow to be neer  
 60. degrees; and Not without reason for the Eye dan=  
 cing from one point, to another, makes litle Inter=  
 valls, w<sup>ch</sup> are Supplied by memory of things past w<sup>ch</sup>  
 so soon after, is neer as lively as y<sup>e</sup> Sence it Self.  
 This Manner of attention, as vision, passing by point  
 with Small Intervalls, Satisfies me that the Conti=  
 nuance of time it self is Made up of pulses. and as  
 from pulses of a watch /so\ by y<sup>e</sup> pulsatile transits of  
 thought, tho Not distinguishable, wee gaine our  
 Idea of time; and the Intervalls between puls &  
 puls of thincking, are in acc<sup>o</sup> of time Nothing, but  
 the thoughts as it were run together; And If by an  
 Almighty power, those Intervalls were magnified  
 Into day's and years; we should make No account  
 att all, as Not perceiving it, but have y<sup>e</sup> Same I=  
 dea of continuation & Connexion of thought, as  
 wee have Now /while\ y<sup>e</sup> Intervalls are so (to us seeming)  
 Inconsiderable. This doctrine of Sensation by  
 pulses (w<sup>ch</sup> wee Cannot distinguish) is very ma=  
 teriall in the Microcosmick sciences, and  
 particularly In the Instance of sounds, and the  
 Glorious symptome called Harmony; ffor y<sup>e</sup> Sake  
 of w<sup>ch</sup> it is thus farr advanced.

<flourish underline>

A further prosecution of the  
partitions of sence, and of Capacity.

In the vulgar acc<sup>o</sup> the Sences are distributed  
In to Number. 5. knowne by their proper de=  
nominations, w<sup>ch</sup> I need Not here Specifie. the  
occasion of this partition is, that Some parts of  
our bodys have a very peculiar<sup>216</sup> mode of Im=  
pressibility, and are Not all affected with any  
Specifick action from without. A cool air that  
Refresheth our outward parts, w<sup>ch</sup> is /termed\ feeling, Makes  
No Sound, tast, or vision; and that w<sup>ch</sup> Excites  
a strong sence of sound, brings No light or Co=  
lours Nor È Contra.<sup>217</sup> All these various Sensations  
are Excited by meer touch /wch\ of Some Materiall parts  
or Corpuscles in motion Striking upon those pecu=  
liar parts /of our bodys\ w<sup>ch</sup> from their grosly different Modes  
of Sence, are called organs, and are accordingly  
characterised; as for Instance y<sup>e</sup> Ear, is wrought u=  
pon by a certein action wee Call Sound, w<sup>ch</sup> action,  
If there were No Ears, would be lost; ~~Not~~ /and\ those Many  
subdivided changes, w<sup>ch</sup> serve as well for delight  
as for discovery, and are thereby most usefull in  
humane life, ~~and give~~ /giving\ us Incomparable Notices  
of affaires ~~going~~ without us, would be Intirely Wan=  
ted; ffor No other part of our body's, If it were at  
all sensible thereby, would afford us any of those  
Ideas wee have from y<sup>e</sup> action that Causeth Sound,  
when it comes to us by means of y<sup>e</sup> proper organ.  
whereof y<sup>e</sup> artifice, & operation, will afterwards be showed.

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<sup>216</sup> The words 'very peculiar', and 'Striking' eight lines down, appear to be written over scraped-back corrections.

<sup>217</sup> i.e., 'the other way round'



It hath bin observed that the force of sensible movements, must be in a sort of mean, Respecting the Quality of y<sup>e</sup> proper organ; for sound may be so strong as shall destroy y<sup>e</sup> fabrick of y<sup>e</sup> Ear and light so fierce to destroy y<sup>e</sup> Eye & Make men blind. This is In y<sup>e</sup> way of Increase but It seems that In y<sup>e</sup> way of deminution, or Exility of y<sup>e</sup> force, the Capacity of sence is unlimited, so that y<sup>e</sup> least force shall Make an Impression, and that Impression be perceived; and wee may as /well\ Inquire for a Minimum of matter, as of Either motive force, or animall sence. The reason Why we are apt to think otherwise, and that very small Impressions Excite No perception at all, is that the attention holds close to greater, w<sup>ch</sup> are for most part In y<sup>e</sup> way to Cover the less; and what is Not attended too, is, as I sayd, to sence, utterly lost. Wee have a manifest proof of this; ffor when fiercer objects are removed, y<sup>e</sup> Milder, of w<sup>ch</sup> wee had No sence before, plainly appear, and so - quovis dato Minor.<sup>218</sup> In y<sup>e</sup> absence of y<sup>e</sup> Sun, starrs Inconceivably distant from us, are seen, And in y<sup>e</sup> Silence of y<sup>e</sup> night, what Inconsiderable Noises are heard? I beleev No dungeon can be made so dark, but a man living in it, should discerne some light. And y<sup>e</sup> whole Globe of y<sup>e</sup> Earth May Not be perfectly opac, or Impermeable by y<sup>e</sup> action of Sound, to a creature under Circumstances proper for  
attending

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<sup>218</sup> i.e., 'less than any given', a mathematical term

Attention to y<sup>e</sup> Impressions of force so Minute.  
And this Consideration may Reconcile the Ex=  
tream Nicety of sence, some animalls, as bees  
are observed to have, who In all their peregrini=  
nations, and discoverys, seem guided more by  
Smell then any other sence.

There is one circumstance w<sup>ch</sup> animates a  
less force, ag<sup>t</sup> a greater, and that I terme  
Heterogeneity, whereby the attention Shall be  
diverted from the fiercest attaques upon y<sup>e</sup> organ  
to others very Inconsiderable; As when In a  
sea fight, or storm, ~~that~~ a gun, thunder,  
or Scarce any thing Ejusdem generis,<sup>219</sup> shall be  
taken Notice off, the Bosons whistle shall be  
most plainly distinguisht, and for y<sup>t</sup> reason /a shrill pipe\  
it is in such cases used. And in a like manner  
If there be a popular Nois to make one deaf,  
the tinckling of a litel bell shall be heard,  
ffor the mode of that Sound is so very diffe=  
rent from all the Rest, that it Must needs be  
attended too.

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<sup>219</sup> i.e., 'of the same kind', a legal term



Hitherto wee have bin Enterteined with the /generall\  
 law's of motion, such as take place ~~upon the~~ /In every\  
 Collision of one body ~~upon~~ /against\  
 another. ~~and are a~~ /whereby wee are\  
~~foundation to examine all~~ /Enabled to Resolve with Some ~~more~~ probability More\  
 complex cases of  
 motion /altho wee cannot account ffor the minute Ingredients of them.\ by ffor wee having  
 lumps of ~~matter ag=~~  
~~gregate of such Quantities of body's, as becomes~~ /Examinable by sence and matter subject to\  
 plainly Examinable by our senses, such /our ~~experiment~~, observation & experiment\  
 as our /owns\  
 members, stones, wood, & such like con=  
 glomerates /~~about us~~ <sup>wch</sup> by cohesion, are as to Melieu, accounted as single & Intire\  
 are Enabled to know In what Man=  
~~ner body's act one upon another, and from there~~  
 wee have /found out & proved\  
 the foregoing rules, <sup>wch</sup> figuratively are  
 Called laws, /as\  
~~because they are observed to be~~ Con=  
 stantly y<sup>e</sup> Same, & Governed by measure, as hath  
 bin Shewed. And from these Examinable cases  
 wee argue to others wee cann'ot Examine  
 and with as great certeinty as humane rea=  
 son can collect of events. ffor If, Events are  
 the same between bodys of certein ration  
 to Each other, In all Sensible magnitudes,  
 what Should Stop the concluding /that\  
 the same rule holds, In cases Immens, as well as demi=  
 nisht ~~beyond senses~~ /past\  
 Scrutiny. And thereupon  
 wee /must\  
 conclude y<sup>e</sup> rules universall, and that  
 there can be No effect's of /Events simple or compound consequent of Gross or\  
 minute Matter clashing, ~~then according~~ /<sup>wch</sup> are Not conform-ble ~~to this~~  
 to these rules or laws of motion.

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<sup>220</sup> The following sheets (up to and including f. 230) have been re-numbered, the older BM numbering (ff. 82-111) having been struck out (in pencil). RN's own alphabetical numbering has also been struck out on the recto, in pencil, as indicated in the transcription. The following sheets (up to f. 270) are written in a brownish ink on a porous, and therefore (to ink) somewhat transparent paper; there is a great deal of showing-through from the reverse, which makes reading difficult.

## B. Events of Motion.

And Now wee propose to apply those rules to the ordinary phenomena of y<sup>e</sup> world, w<sup>ch</sup> are /but y<sup>e</sup>\ Events of Numerous clashing's of Irregular & cheifly the minuter Matter, & proove If wee can /from thence\ Resolve them with such probability, as Rationall creatures ought to assent too.

The first phenomenon of compound Motion is fluidity, whereof the Experience as well in y<sup>e</sup> air as comon liquor's, is that conglomerate or fixt bodys pass Easily through them, And that smoak and vapour /In y<sup>e</sup> air & dust &c In liquors\ ~~w<sup>ch</sup> wee can see,~~ as also liquours of different colours, all w<sup>ch</sup> are discernable ~~to~~ /doe\ dissipate and dispers, untill the Mixture becomes uniforme, w<sup>ch</sup> demonstrates that there is a continu= all motion of the parts of such fluids, And the like is made very sensible In boyling of powder of Alabaster or putty for Cement w<sup>ch</sup> at a certain degree of heat shall ~~goe into motion~~ /be in Motion [~~---~~?] and exq<sup>uisitely</sup> Resemble a fluid; so as being Stirred to ffall levell againe, and is certainly /in\ a degree of fluidity, but matter pulverised to y<sup>e</sup> Greatest Nicety ~~will Not Induce the fluid forme,~~ as flower or powder of wheat & y<sup>e</sup> like ~~do~~ will Not The More Induc the fluid forme. And there is another ocular argument of the Intestine Motion of fluid Matter, w<sup>ch</sup> is the heaping up in piramits those animalcules wee Call mites, their Action Shall In a Short time ~~(the Not so soon as Liquors)~~ reduce y<sup>e</sup> heaps, & Spread them as broad as liquors doe, but Not so fast, becaus y<sup>e</sup> Mites

are Grosser, and motion slower then of the liquors,

There May be observed ~~that there are~~ other properties of liquor's, as that some /as water & spirits\ will mix, ~~& others~~ /others not\ Not, as oyle & water will not mix, but water and Spirits will, Some will burne as spirits /as oyle, others\ Not; some will Evaporate & be so Converted /may be translated from ye forme of one fluid\ Into another, as water Into Air /by Evaporation\. And air will againe depose water; Some will Easily Explode, other Not without Great difficulty /some heavy others light\ w<sup>ch</sup> with other particulars/itys of variety\ may be considered. In time, at present wee shall take o<sup>r</sup> view's More generall.

The first thing to be Considered Shall be the Manner of a solid body's passing in a fluid; w<sup>ch</sup> I thinck hath Not bin rightly handled by any. the true way of observing how a body passeth thro a fluid, is to observe how a fluid passeth ag<sup>t</sup> a body. And that is allway's In ye manner of a wedg, both before and behind. And If the body be flat, & Not wedg fashion, It takes of the fluid to supply it. If the body be wedg fashion, as A. <diagram> then as ye passing towards F. opens ye fluid. F. about B. & C. so It closeth againe about D. & E. and the part's are left (as to ye Main) In ye Same posture as they were. It is ye Same If the fluid pass from F. towards G. ffor ye parts fall in together towards G. & open, towards F and In the passage lick the sides of the body, & /goe away\ near the Sa In ye Same posture as before. w<sup>t</sup> may conduce to alter their posture or disturbe their order I may shew

## d. Events of Motion.

<diagram> If the body be not pyramidal In the Cours  
of it, then a pirimid of y<sup>e</sup> fluid is driven be  
fore it and drawne behind it as here. the  
demonstration whereof is this, If y<sup>e</sup> parts at a. must  
pass away towards b. or c. to Make way for the  
body, It cannot pass at all. ffor ffirst there must be  
time ~~from~~ for a. to move that Space, & it Cannot  
be In Instanti.<sup>221</sup> Then Next the part's at. a. accor=  
ding to the direction of the Impuls of the body u=  
pon them, cannot move away. and what is Sayd  
of one order of parts next y<sup>e</sup> body So of other's,  
lessening untill to a point at d. and the direction  
the body Impresseth at y<sup>e</sup> Sides may lessen every  
cours. as A. shall carry b. with it, but thro of. c.  
<diagram> The like for the cone or piramid behind  
towards. e. ffor the parts. f. [cannot cannot?]  
be away In a moment. and then Either y<sup>e</sup>  
pressure of y<sup>e</sup> fluid, or plenitude of y<sup>e</sup> world, Must  
force that to follow, w<sup>ch</sup> cannot be left behind.  
and ~~It is y<sup>e</sup> Same~~ If y<sup>e</sup> Current Comes from d. to. e.  
It shall leav that ~~body~~ /fluid\ f. /behind it\ becaus it hath No means  
to strike it away, being covered by y<sup>e</sup> body. a. so  
It must leav /upon\ y<sup>e</sup> body /y<sup>e</sup> fluid\ d. becaus it stops on the flat  
b.c. Wherefore the motion of a fluid, passing or  
being passed by a Solid, ~~is w<sup>ch</sup>~~ Is In y<sup>e</sup> Same Manner  
affected and doth but open and Shut. and /If y<sup>e</sup> body were Exquisitely\ ~~there~~  
~~is neither any~~ /ne Glabrous no\ part but what is borne along, /would\ put  
out of /its\ order, by y<sup>e</sup> motion, but onely a series from  
before opening, to behind closing, & so it is left.

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<sup>221</sup> i.e., 'in an instant'

But there are ordinarily many Circumstances  
 w<sup>ch</sup> makes More disturbance, as the rugged Sides of  
 y<sup>e</sup> body & y<sup>e</sup> fluid clasping it close, is draggd along  
 and the contiguous parts draw other's, w<sup>ch</sup> send's  
 forth y<sup>e</sup> disturbance to some distance. or the fluid  
 may have a Spring, as y<sup>e</sup> air, or flow in waves w<sup>ch</sup>  
 tend to subside againe, as water. And It is Re=  
 markable, that when the surface of water is  
 moved conformely to y<sup>e</sup> wind, & is Curled in an  
 order of waves. If a Ship Sails thro such water,  
 the surface is disturbed, & y<sup>e</sup> Cours of y<sup>e</sup> waves  
 there broke, so that the wind & other water doth  
 not soon, reduce it to a conformity, whereby  
 the path of the vessell, is visible as a conside=  
 rable time. & y<sup>e</sup> seamen Call it y<sup>e</sup> wake, for  
 y<sup>e</sup> walk of of the ship. The faster a vessell or body  
 moves thro a fluid the more acute y<sup>e</sup> front  
 & rere portion's of y<sup>e</sup> fluid are, & the slower the  
 more æu blunt. w<sup>ch</sup> is a reason why to bear a  
 body very swift thro, take's More force In pro=  
 portion, then Slow, becaus it bear's a greater  
 portion of water, and the action of opening  
 is more dilated, becaus things /for want of time\ doe Not give Way  
 to a Swift as to a Slow Motion. And whatever y<sup>e</sup>  
 case is there is allwais a stated measure of y<sup>e</sup> fluid  
 concerned, w<sup>ch</sup> is as so Much Impediment to the



## F. Mixt Events.

proceeding, and is Quasi an addition to the Moving body of Quantity Equaling that Impedim<sup>t</sup>. there fore when a body, if struck In fluido, that is the account, viz<sup>t</sup> the body & its Impeding fluid, both w<sup>ch</sup> allowed for, the case is y<sup>e</sup> Same as If a body, so Much bigger, were Struck, In (Imaginary) vacuity. If a body be sent very Swift out of one fluid Into another, as from air to water; It shall carry it's tail of air with it for that cannot be shak't off. A cannon bullet moving /very\ S<sup>e</sup> Swift thro comon air Compresseth it, and it break's away by snatches, w<sup>ch</sup> makes y<sup>e</sup> Rending Sound it hath; and a tail of smoak shall follow it. ffor y<sup>e</sup> bullet is Rugged, & lay's hold of the air, w<sup>ch</sup> disorders it much, as y<sup>e</sup> rending sound also Shews, and it is likely, that in that very swift motion, there May be often a torricellian vacuity In y<sup>e</sup> rere of y<sup>e</sup> bullett. If y<sup>e</sup> forme of body be Not regular, the dis[=?] <diagram> order of y<sup>e</sup> fluid is More, as tho the opening /being all\ towards a. & Not towards. C. the vis Impress[a?] of the closing at [bc?] Shall proceed and from b. goe on & vorticall between b. & c. so it is No wonder that fluid's are so much disturbed by solids moving thro them, ffor ffew or No solids are either exquisitely Glabrous or very regular.

It is to be Noted, that by y<sup>e</sup> Same degrees as a current of fluid would make a sold Conforme in all things with y<sup>e</sup> Motion of it, It would also, If

If Stagnant, & y<sup>t</sup> body In Such motion, bring it to perfect rest. ffor So much of the fluid as is to be Moved by y<sup>e</sup> body, or (w<sup>ch</sup> is y<sup>e</sup> Same thing,) being in Motion is Resisted /Impeded\ by y<sup>e</sup> body workes contrarily to Retard, or bear upon it. And that is Gaged by the breadth obverted to y<sup>e</sup> Cours of y<sup>e</sup> fluid. As for Instance. a current Sets from A. to B. Its Influence <diagram> on y<sup>e</sup> body C.D. is the ~~per~~ bredth perpendicular to the current as C.D. and If y<sup>e</sup> front takes any other shape as C.D.O. or C.D.E.F. It is the Same current or [Quantity?] of y<sup>e</sup> fluid that bears upon it. therefore it is a good rule, that the Measure of the force of a /Current\ fluid upon a solid Immers is according to the Quantity w<sup>ch</sup> would pass free if y<sup>e</sup> body were away. and however figured y<sup>e</sup> front is the same Gage holds, that is y<sup>e</sup> Same Quantity of water would pass free If the body were away. And as it is so of a Gibbous front, it Will be Same In an hollow or Concave front. As A.B. Hence it <diagram> ffollow's that be y<sup>e</sup> front of w<sup>t</sup> forme it Will Each part susteins y<sup>e</sup> force of y<sup>e</sup> fluid according to the part it hath in the perpendicular Gage; as the side c.d. Susteins y<sup>e</sup> part A.c. and b.d. that of a.b. And for the sane reason when water presseth, as In a vessell with its weight, w<sup>ch</sup> is but as a Current of water

## H. Mixt Events.

water towards y<sup>e</sup> Center of y<sup>e</sup> Earth, No More Water  
 presseth /to goe out of a foramen\ then can pass, ~~at a foramen made in~~  
 w<sup>ch</sup> is a rule of waterworks. ffor as the vent is  
 Greater, or less, so Must the Strength of their force  
 be. the Equality is when No More water is sent then  
 the vent lett's pass, as thro a true /open\ Cilinder it is. but  
 If the vent be less then the Cilinder, to Make the  
 same water pass in y<sup>e</sup> Same time, demands a pro=  
 portionable Inceas of water force. Hence also it is  
 Impossible, water Should rise at the fountaine  
 higher then at the Spring, tho y<sup>e</sup> Entrance pipe  
 be tunnel fashion, for whatever y<sup>e</sup> vent is, that  
 <diagram> Gageth the force of the water bearing to pass thro  
 it. the Rest is susteined by y<sup>e</sup> Sides of y<sup>e</sup> vessel, of  
 what forme soever they are. as the water at A.  
 Rests on y<sup>e</sup> Sides, Except what May pass at B. and  
 that bears upon b. & No More, so Equall ag<sup>t</sup> E=  
 quall make's a ballance in y<sup>e</sup> levell. The like holds  
 If a body be Immers't, & lighter then water,  
 the force to rais it from so much water as can  
 come in its place. and If the body have force as=  
 much to sink downe, as the water w<sup>ch</sup> would Come  
 in its place hath, It is Immers't, If More sinks  
 If less, riseth above y<sup>e</sup> Surface, according to the  
 doctrine de Insidentibus Humido. Water pas=  
 sing y<sup>e</sup> Sides of a strait body, or thro a Strait Ci=  
 linder, or Inclosed in a vessel, /If y<sup>e</sup> forme\ hath No /Impedim<sup>t</sup> or\ Support  
 from y<sup>e</sup> Sides but on account of friction; becaus the  
 fluid

fluid clasps & holds by y<sup>e</sup> Irregularity's of y<sup>e</sup> Surface  
 and So is Considerably Impeded, w<sup>ch</sup> bated y<sup>e</sup> passage  
 is free, or all y<sup>e</sup> force ly's on y<sup>e</sup> bottom: And when  
 water, sand, or Shott is put in very long tubes, this  
 is So considerable, that much of y<sup>e</sup> force hang's by y<sup>e</sup> Sides  
 & is Not felt at y<sup>e</sup> botom. Where a body is Immers't  
 If a formamen were made in any part of it above  
 or below, or in y<sup>e</sup> Sides, y<sup>e</sup> water would Enter; there=  
 fore all parts round an Immers't body beare the  
 pressure of y<sup>e</sup> water from what Caus Soever it is; as  
 also y<sup>e</sup> pressure of y<sup>e</sup> air; w<sup>ch</sup> is y<sup>e</sup> reason that animalls  
 are Not crush't by such weights, as th fluid pressure  
 would be if it lay all on one part. this was a Secret  
 to y<sup>e</sup> Grave author of y<sup>e</sup> Non gravitation of fluids.<sup>223</sup>  
 But the rubbing of fluids ag<sup>t</sup> y<sup>e</sup> sides of body pas=  
 sing them is an occasion of divers Effects, and par=  
 ticularly, that wee call Eddy's; for when the con=  
 tiguous fluid is drawne that draw's others, & so in  
 a contour, till it is put in a cours. directly con=  
 trary: So a Current as from a mill /sharpest in one ~~line or~~ place\ while y<sup>e</sup> banks  
 and holds or cours' y<sup>e</sup> water neer them, {---?} takes  
 or it takes Not y<sup>e</sup> whole force; ~~is~~ snatcheth this  
 calmer water, and Make a Reflex current, or  
 vortications by y<sup>e</sup> Sides. flame doth the same thro  
 the air, for it Snatcheth y<sup>e</sup> contiguous air &  
 that the next, &c. so In y<sup>e</sup> open air there is al=  
 wais Eddy's as well as Currents and In a tunnell

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<sup>222</sup> The original heading 'p<sup>r</sup>' has been struck out and the sheet re-used.

<sup>223</sup> Matthew Hale, *An essay touching the gravitation, or non-gravitation of fluid bodies, and the reasons thereof*, London, 1673. Sir Matthew Hale, the leading lawyer of the generation previous to his own, is an important character in both RN's autobiography, and his biography of his brother Francis North. RN was always quick to mock both Hale's social status, and also pretensions to learning (other than in the law).

205v

K                    Mixt Events.

where there is Not room for the Contour, the Current is drawne all together, & with y<sup>e</sup> flame augment Each other

Another Event of Compound motion is that w<sup>ch</sup> is Called pressure, or, with Cartesius, Conatus ad motum, w<sup>ch</sup> he did not well Explain. ffor as he useth it, conatus is a sort of medium betwixt motion and rest. there is not In nature, such a thing as conatus ad motum, more then the Qua= lity's of Aristotle, but Every body take it With w<sup>t</sup> Regards you pleas Either is Sayd to Move, or rest; Now there are secret causes, w<sup>ch</sup> have their Effect, Some= times sensible to us, & Sometimes Not. And If there be a knowne Impediment, why they are not sen= sible, w<sup>ch</sup> being removed, y<sup>e</sup> Effect y<sup>t</sup> was Not before, then becomes sensible, wee call yt caus pressure. and Mean onely ready to have a knowne Effect, If the Impedi= ment be removed. as weight for Instance, taking it to proceed from a perpetuall Striking of Small body's upon the heavy thing, tending to drive it downwards; this Striking is perpetuall and Each stroke litle as it is, hath y<sup>e</sup> Effect /~~tho Insensible~~\ proportionable, as all strokes have /tho Not sensible to us\ according to y<sup>e</sup> Quanty it falls upon. and that is, If y<sup>e</sup> weight be upon y<sup>e</sup> Ground, y<sup>e</sup> whole Earth; but If you undermine away y<sup>e</sup> Impedi= ment, sensible.



Authoritys.

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<sup>224</sup> This leaf is numbered 207 (in pencil), the number then struck out (in pencil).



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It Requires Some close Reflection's on the Con=  
 dition of humanity, to find out a tollerable  
 reason why Men, once In a right way, Should  
 So Readily deviate from it, as wee find they  
 doe, In Most Exercises of their faculty's; this  
 is frequently observed in languages, and arts,  
 w<sup>ch</sup> I will not here Rehears, but In short as=  
 scribe the caus, to Corrupt Interest /and\ that ei=  
 ther In y<sup>e</sup> way of power or Mony, /ffor Crafty men\ ffind a true  
 wisdome generally Enterteined, Inconsistent  
 with their Model, and then they work by  
 deceitfull arts, to Make men batter their  
 wise freinds, & curess their fals ones. did Not  
 y<sup>e</sup> Greek's destroy Every Extraordinary good  
 man they had? and So y<sup>e</sup> Roman's who by  
 ill Men were perswaded to banish Even Ci=  
 cero,<sup>227</sup> ffor what he did In p<sup>r</sup>serving them. I need  
 Not Come neerer home, unless to Referr this  
 Reflection to a picture drawne by a poet,  
 In his alchemist, where the fool were made  
 to take their cheaters part & drive away  
 their freinds;<sup>228</sup> so is the world. I say this Must  
 come from Corrupt Interest, ffor the true Inte=  
 rest, never Suffered by truth, & open dealing,  
 Nor sought protection with decei/~~t~~\ving I know  
 No

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<sup>225</sup> In this rich and complex essay RN deals with the history of science (natural philosophy), the recent eruption of the New Philosophy, and the operation of institutional and personal prejudice to advance and/or hinder the processes of that change. 'Authority', therefore, is the whole fabric of inherited, or currently authorised, dogma.

<sup>226</sup> This page initially numbered 208 (in pencil), that number struck out (in pencil). RN's own page numbering (A, B, etc.) also struck out (in pencil) on the recto side, where shown. There are therefore *three* struck-out numberings on this page (see note on f. 201r, above)!

<sup>227</sup> Marcus Tullius Cicero (106-43 BC), the very type of the unjustly persecuted public man.

<sup>228</sup> One would imagine that this is a reference to Ben Jonson's comedy *The Alchemist*, first performed in 1610; the reference is vague enough to allow one of a number of characters in that play to stand as the fool working against his own proper interests. I won't labour in that character myself to seek to establish the analogy too firmly.

## B. Authority's.

I know No profession hath More Suffered In  
 this unhappy fate, then philosophy; ffor wee  
 know well y<sup>e</sup> world hath More then once bin in  
 a right way, and then by Some odd humour  
 or accident, as to y<sup>e</sup> publick it seem's, It is put by  
 The ancientest of the Greek philosofer's  
 whom they Call atomist's, and setting aside  
 democritus & after him Epicurus, are Not Much  
 Now taken Notice of, were certainly In a  
 better way of philosophizing then their suc=  
 cessor's, who all at last ffell in with aristo=  
 tle. logick was Not knowne In their time, but  
 was ham'ered afterwards, and by Aristotle  
 formed into an useless, I might say pernicious  
 art of Wrangling. w<sup>ch</sup> did Not subserve y<sup>e</sup> Ends  
 of knowing, but of disputing. and was at  
 best, but a Mean's of defence, against the  
 Quonumdramers Called **Sophists**,<sup>229</sup> who by the  
 abuse of argument, put men In Mind of  
 setting reason right, by y<sup>e</sup> Same sort of trick  
 as y<sup>e</sup> others had used to corrupt it. that is to  
 avoid Nice caption's, by as Nice distinctions, and  
 so by unravelling all thing's confounded all  
 knowledg. For when any Question Came to be  
 Resolved, they forth applyed their distinctions  
 and so

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<sup>229</sup> 'Quonumdramers' = conundrumers, i.e., pedants, riddlers. 'Sophist', from the Greek word for wisdom, as is the word philosopher, a general term employed in classical times for teachers and public intellectuals. The word is also (and most often more recently) used in a perjorative sense, as here by RN.

And so turned /hath logick depraved\ all art's & Sciences, w<sup>ch</sup> is well knowne was Aristotles Custome. It is almost Impossible but Aristotle must in his phisicks have fallen into democritus way, w<sup>ch</sup> was to Resolve all things Into Matter and the Modes of it, but his logick humour Spoyled all. ffor he was certainly y<sup>e</sup> Greatest witt & Most Capable In that age. But as ffor the Rest, they did Not So clearly Comprehend the value of it, to fall In with & Reteine it.

I doe beleev that the heathen priest's thought Aristotles phisicks lest hurtfull to their trade, and the other way, more dangerous, ffor Aristotle was suited y<sup>e</sup> best in y<sup>e</sup> World to Secure the heathen Religion, deserving hardly the name of a philosofer, as Medling onely With a few appearances here on Earth, leaving vassly y<sup>e</sup> Greater of y<sup>e</sup> univers to be Managed by God or petty Intelligences. and all his Qualitys, Naturall Endowments, Gravity & levity were Referred to y<sup>e</sup> diety. No wonder that he had so Strong a party and the ancient Naturalists were layd aside, Especially since wee have seen & doe See Now y<sup>e</sup> Same thing from y<sup>e</sup> Conduct of the Roman hierarchy,

D-

## Authority's

There Might be farther reason why Aristotle  
 obtained So Much in y<sup>e</sup> World, w<sup>ch</sup> is there Ne=  
 ver was before him, a /not any other\ Compleat body of  
 phisicks, ~~or Not~~ but what time had destroyed  
 so upon y<sup>e</sup> Revivall of learning, Men were  
 forc't to profess that philosophy w<sup>ch</sup> they found.  
 plato wrote Not in So Conspicuous a method  
 his Notion's lay dispersed, & None determined.  
 as for the hypotheses of y<sup>e</sup> other filosofers, they  
 [lay lay?] scattered about in Many books /and there occasionally mentioned\ Not  
 collected together till these latter ages, & Much  
 of them from hints & by guess, and for want of  
 the originals, very Imperfect. The best acc<sup>o</sup>  
 of any, is Epicurus, tho the philosophy of other  
 sects Might be found Scattered In authors, but  
 as for his Epitomy in 3. letters, it is so concise  
 and obscure, that It Could Not be understood  
 without other advantages. but When Good  
 Skill in the latine tongue Was Joyned with a  
 filosoficall temper, lucretius<sup>230</sup> gave y<sup>e</sup> best  
 Sight of that Sect, & much light, as well to  
 those Epistles, as other authors. Epicurus Made  
 litle Nois In y<sup>e</sup> World before Gassendus collected  
 his philosophy, /Except\ onely those Calumny's of vo=  
 luptuousness, to be found in other authors

But

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<sup>230</sup> Titus Lucretius Carus (c.99-c.55 BC), author of *De Rerum naturae* (*On the Nature of the Universe*), a poem, discovered in 1417, which was the principle source for the ideas of Epicurus, and an influence on Pierre Gassendi.

But it Seem's very apparent, that the Mechanick or Corpuscular hypothesis, was of the ancienter Sects, and the cheat of Qualities<sup>231</sup> Came In, & posses't y<sup>e</sup> World afterwards; And If wee Compare the Moderne with y<sup>e</sup> ancient, there is really Not Much difference, bating that Grand flaw of vacuum, w<sup>ch</sup> I thinck hath y<sup>e</sup> wors End of y<sup>e</sup> Staff Now, tho there are some, & No small ones who would, by their authority, & without reason or Experiment reinstate that. In Short the Elder philosophy, was More after truth, & y<sup>e</sup> Latter More ffitt ffor dispute; as If it were contrived to be a Subject to Exercise y<sup>e</sup> brawling part of logick upon. and Wee Must Grant that In all the Sciences w<sup>ch</sup> depended Soly upon a Mans Reason, Aristotle and his sect had y<sup>e</sup> advantage ffor In subtile Spinning, Such as wee find In his Ethicks, polit. Rhetoriks, & Hist animal' None went beyond him. but look wee after the truth of Naturall being's, and our sensation's from them, wee should profit More from one that follows y<sup>e</sup> plow, then from him. And it will Ever be found that subtileizing in a wrong cours, Ever did & will offuscate science, and Establish positive Ignorance

<flourish underline>

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<sup>231</sup> i.e., Aristotelian thought. RN followed Descartes in rejecting qualities as useful categories, emphasising the role of the senses and judgement in making the word seem as it is.

## F. Authoritys.

Thus farr wee have Enough to Shew that Autho=  
 rity hath a strang Influence upon the study &  
 opinions of Mankind; And that it is Not reason  
 utility, or the plainest demonstration's that will  
 [pass?] upon y<sup>e</sup> belly of a p<sup>r</sup>possession, but In know=  
 ledg, as In faith, & worldly Interest Men fall Na=  
 turally Into faction's, and are ready Jurare in  
 verba Magistri.<sup>232</sup> Nor is it the speculative Sort  
 of men that are leader's thus to y<sup>e</sup> p<sup>r</sup>judice of  
 knowledg, but Men in publick post's, Either  
 In Church, state, or y<sup>e</sup> Scools, that have the  
 disposing of p<sup>r</sup>fermen'<sup>ts</sup> & honnours. It is Such  
 that youth Incline to observe, and then fall  
 p<sup>r</sup>possest, & perhaps In Cours, come into the Same  
 Interest, and So uphold, a rotten fabrick that  
 they Gaine by. then are Confederacy's &  
 policys, far from Meaning good to truth, but  
 the trade of y<sup>e</sup> colledg. I wonder what mean's  
 so many professor's places, with Great Salary's  
 Endowments, and ffees of Graduates, If logick  
 were Not to be Chapt, and a vane chiccane  
 In science to be Maintained: And here is all  
 y<sup>e</sup> Good that hath Come of the vitiligatory part  
 of logick.

let it be observed this way of disputing, owing  
 to that forespoken art, bred a Sect of the  
 most

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<sup>232</sup> i.e., 'to swear in the words of a master', from '*Nullius addictus jurare in verba magistri*' (I am not bound to swear in the words of any master), Horace, Epistle I, 1:14. The people RN criticises embody the opposite of the ideal of Horatian independence as expressed in the Epistle to Maecenas.

Most vain & verbose sect y<sup>e</sup> Ever y<sup>e</sup> Sun Saw  
 scool men. Lombard<sup>233</sup> their founder /(whom none followed for [above?] 100 years)\ doth Not In=  
 troduce Aristotle, but is full of his Nice distinc=  
 etious tions & frivolous Questions, but these  
 were augmented to a vast proportion  
 by letting in Aristotle. Surely Want of Matter  
 must occasion that trade of dry distinctio=  
 ning & foolerys of y<sup>e</sup> Scoolmen; w<sup>ch</sup> can a=  
 gree with none but Capacity's, Infra Medi=  
 veritatem positis;<sup>234</sup> and Gave M<sup>r</sup> Hobbs occa=  
 sion so to Say, that their vanity would appear  
 by Endeavoring to translate anything they  
 write, or speak. ffor In good truth It is Impos=  
 sible to hold discours with them but In their  
 owne lingua, so that their Notions are In=  
 expressible but In latin termes, & that de=  
 monstrates they are Nothing Els but Words.  
 It were well If they had Spoyled onely the  
 philosophick sciences, & Never had Medled  
 with Religion, w<sup>ch</sup> they had almost con=  
 founded too, and had Gone thro Stitch,<sup>235</sup> If  
 the Reformation In Europe had Not given  
 a check, for that let in liberty & then New  
 philosophy, ~~that~~ /w<sup>ch</sup> as that\ Moves on clear principles /& reasoning then y<sup>e</sup> former\  
 Entered /with\, and had a Renovation both together  
 and Now In Some country's are in a flourishing  
 Estate.

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<sup>233</sup> Petrus Lombardus (1096-1164), author of *Libri Quattuor Sententiarum* (*The Four Books of Sentences*). Aristotle's texts arrived in the thirteenth century especially with Dominican scholars, such as Albertus Magnus (c.1200-80) and Thomas Aquinas (1225-74).

<sup>234</sup> i.e., 'set below half truth?' (I have not been able to trace this, if it is a quotation)

<sup>235</sup> i.e., 'to carry a task through to the end, to complete'



H

## Authoritys.

It were well If university's had other Methods  
 then this /of\ ~~disputing method hath~~/of disputing so\ planted a=  
 mongst them. they breed /Enter\ their youth to /with\ lo=  
 gick & philosophy, & such as, If ~~it were~~ pos=  
 sible would /will\ Make them hate both. the Scol=  
 lar was Not Much to be blamed, that ~~Not~~  
 being able to Comprehend /puzled about\ homogene, and  
 heterogene, Sayd If he were at home again  
 he would Never Come hither againe.<sup>236</sup> they  
 should be ~~drawne on~~ /Enterteined at first\ With polite /& Encouraging\ learning, such  
 as is knowne by ye title of Humanity; and  
 be made to practise languages by transla=  
 ting, and pronouncing. ~~And for~~ /But\ philosophy  
 It is /an Exercise of ye Judgm't & therefore ffitt for ye More calme & ~~ffor the~~ Sedate and  
 aged Minds; ~~that~~ /such as\  
 have has ye World In their view, and have  
 observations of their owne /whereafter\ to test their Study's.  
 and are Not so apt to Resolve Suddenly, as  
 /raw\ youth are, whose minds are active, & cannot  
 Stay to be advised, but take that w<sup>ch</sup> first  
 Impresseth their candid apprehensions /right or wrong ipse dixit<sup>237</sup>\ ~~But~~  
 /and from thence Grows p<sup>r</sup>judices very hard, if Ever possible to Remove\ of all Study's  
 p<sup>r</sup>paratory to philosophy, None are  
 like /comparable\ the Mathematick's. It is allow<sup>d</sup>, that the pro=  
 cess is from such clear principles and Securely  
 conducted, Either from them to the theorem, or from  
 that to these, that the create a disposition, What  
 Ever the Subject, to argue plaine and Sound.

And

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<sup>236</sup> Just ... notice the pun; the same joke is used in the life of Rev. Dr. John North, 1744, p. 238.

<sup>237</sup> i.e., 'he himself said it'

And It makes them shake off that humour  
of Chiccane, that triflers are so full of, Especially  
when Reduct to an art, as In Sillogizing.  
It is No Matter What Study's men take too,  
accompanying these of the Mathematick's,  
w<sup>ch</sup> Should Ever be the ground proposed for  
youth to rise in learning from. Some May  
be by profession Inclined to theology, others  
by disposition to history, Mathematicks, law  
or Eloquence, w<sup>ch</sup> latter demands all y<sup>e</sup> Rest,  
& w<sup>ch</sup> with us Shines More in pulpets. And In all  
reason the penchant of youth, Should Not be  
Slighted, but made a Mean's to draw them  
on In Industry & Study, w<sup>ch</sup> diverted, turnes to  
Idleness & debauchery. Is there any reason that  
all Men Should tast y<sup>e</sup> Same crabb; What  
is it Els, to have a Setled Cours of Study Im=  
posed on all Capacity's & dispositions, first  
logick, then phisick's, & Metaphisicks, &  
some Ethicks, but that is y<sup>e</sup> least. then when  
a youth is capable by an happy memory to  
ans<sup>r</sup> deffinitions out of Senertus Burgers dicius  
Magirus,<sup>238</sup> &c. Especially If he can tell the Num=  
ber of the Category's, & Name them; and  
the solution's of calor, frigus<sup>239</sup> &c (too Nauseous  
to translate) out of Aristotle, he is ready for  
the

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<sup>238</sup> Johannes Magirus (c.1560-96), German physician and physicist.

<sup>239</sup> i.e., 'hot, cold'

## K. Authoritys.

ffor his Batchelours degree, W<sup>ch</sup> is obtained standing buff in Such opposalls against all Superiors, that pleas to attaq them.

It may be sayd that the cours of the publiq Schools In university's, as also their private colledges, as is Setled In this Method, and If Aristotle & his scool were Not held In place what should they doe with their youth? ffor Experiment's /on w<sup>ch</sup> y<sup>e</sup> new filosofy leans\ are for riper year's, & the charg Not Supportable by Student's. I Grant Experiment's, or rather the judgm<sup>t</sup> of Experiments, is for Riper year's, and the use of them I Shall discours of apart. But surely there is study Enough without Expermim<sup>ts</sup>. If Hypotheses are sought, then is the cartesian better then the Aristotelian. If Expermim<sup>ts</sup>, how many book's are there of Naturall History, and accounts of Experiments? Is Not there Antiquity's, languages, law History, Nay all ancient author's to be read, & most Especially Aristotles works, ffor their Excel= lency, ~~except~~ /but in\ his phisicks, and even that too, ffor the history of the opinion's of o= ther filosofers, to be had No wher Els but there. And yet those /need\ Not be crambd downe ffor /as\ act's of parliaments in learning.

I must ~~confess~~ /conclude here with observing\ as I sayd, the old philosophy by maintaining the logomachy is fitter to uphold professors places, then the New, w<sup>ch</sup> doth Not build on words, but things.

It is Strang to Consider, how that when once the authority of Aristotle was broken in a small discovery the whole world fell away Immediately; as When the Selvedg of a cloth is broke, the rent runs thro Immediately. So there was Quick work, for When the way was perceived to lead avers from truth, the next Instance was a totall lasting off. And it is No Wonder Such authority besotted y<sup>e</sup> Minds of Men, considering his systeme was Nothing but y<sup>e</sup> cobweb of his owne brain; so Meer a fancy that his succ<sup>s</sup> Could add nothing of their owne heads, but wholly depended upon his text, as to what Could Not otherwise be proved, w<sup>ch</sup> Made that formerly obtain /in, & secrets\ for strangest of proof, /and So they fell to Refining upon that for meer variety not minding the Nature of things [---?] in y<sup>e</sup> world\

There ~~may be~~ /were\ Many ~~fancy's of the Means~~ of /occasions y<sup>t</sup> gave the start to\ this Great chang. as at first Ramus<sup>240</sup> attaq & victory In the logick-Sphear. the Reviving ancient /-er\ Sect's by Magnenus, Gassendus, &c. and lastly & Most effectually those Many brave spirits w<sup>ch</sup> rose up in y<sup>e</sup> world about the  
same

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<sup>240</sup> Petrus Ramus (1515-72), French humanist scholar

## M. Authority's.

time, all leaving Aristotles seducements & aiming at an Explication, of y<sup>e</sup> Mundane Systeme by body and its Modes: And these were all Most Ingenious /persons\, & Such as Could Not learne Much of Each other. as verulam. Gilbert, Gassendus, Hobbs. D. Cartes.<sup>241</sup> &c. and No branch of phisicks took light readyer then Astronomy, by admission of the Copernican Systeme, ag<sup>t</sup> w<sup>ch</sup>, once considered & ventilated abroad, Nothing could stand. One May apply a latin saying, fiat Justitia, & ruat coelum<sup>242</sup> to the downefall of y<sup>e</sup> solid orbs & epicicles w<sup>ch</sup> made way for just Notion's of y<sup>e</sup> heavens w<sup>ch</sup> If ever knowne clearly before, had slept for Many century's of years. And here wee take leav of the authority of all former ages as to Naturall philosophy, ffor these Noble witts have wrought out of their owne braines, assisted w<sup>th</sup> what /usefull\ Hint's Could be had from antiquity ~~they thought usefull~~, and various Experiments and discovery's, ~~materia's ffor a~~ made or Encouraged by them, a Body of phisicks Neerer truth then Ever y<sup>e</sup> World had before; and w<sup>ch</sup> is More, have Established Such Maximes /ffor y<sup>e</sup>\ of searching & Judging of truth In those Matters, as will forever be layd hold on, by y<sup>e</sup> Inquisitive and made use of In resisting vaine opinions.

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<sup>241</sup> i.e., Francis Bacon, William Gilbert, Pierre Gassendi, Thomas Hobbes and René Descartes.

<sup>242</sup> i.e., 'let justice be done though the heaven's fall'

Of these the Noble D. Cartes, Is justly account=  
 ted the chief /most Eminent\ having /had\ Such a vast genius  
 and penetrating, as hath unraveled /as to analyze\ the  
 univers, & exposed it to view, /denuded of all\ as If it Were  
 Naked. It is manifest he was well vers't in  
 all the learning of ye ancient's, and doubt=  
 less had Many hints from them, but he could  
 Not rest, as they did, at things w<sup>ch</sup> appea=  
 red clear to the senses; but past them /for w<sup>ch</sup> they\ a=  
 way without Examination /ing any caus for them\ as that heat  
 doth rarefie, & Rais vapours, & ye like /without examining ye Caus, or how\. but  
 /they were so performed nor\ and Inquired Not how, but Made use of Such  
 observation's, In Explaining thing's More  
 difficult the ancients /made\ made ye Element's  
 principles and Gave them Quality's. they did  
 Not Consider body's as they were in them=  
 selves, but as they Seemed In conjunction  
 with any of our Sences. /they took ye world as they found it, not Inquiring how it Might Come  
 into such posture\ But Cartesius Sur=  
 monted all these stopp, and Rested No Where /Sought No limits\  
 on this side the ultimate scope of hum=  
 ane thought.

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<sup>243</sup> The whole page of text has been crossed out with a single penstroke running from the top right to the bottom left.

N. Authoritys.

of All these wee must ffix o<sup>r</sup> Eyes on Cartesius  
 as the Most transcendent genius, Who hath  
 by the Meer strength of his Mind & thought  
 Gone /far\ beyond /~~---~~?] y<sup>e</sup> Improvem<sup>ts</sup>\ the other's had but In hints  
 and project, and ~~that also to be~~ /and w<sup>ch</sup> they Never /but\ proposed to be\ Compas't  
 /but\ by Experiment's, & ~~Not~~ /rather then\ Invention. his In=  
 imitable peice of Geometry Shew's both the  
 force /comprehension\ and clearness of his ~~thinking~~ /Mind\, and  
 how usefull Mathematicks are In regu=  
 lating the judgm't, In all Inquiry's Espe=  
 cially such as are filosoficall. And yet  
 an academick humoured Oxonian,<sup>244</sup> Must  
 needs charg him to have Stolen ~~from M<sup>r</sup>~~  
~~Harriot,~~ of the Invention of bringing the  
 data, & Quesita on y<sup>e</sup> Severall /divers\ sides of the  
 Question. As if /y<sup>e</sup> author of\ So uniforme a Structure /in mathematicks\  
 /founded\ ~~began upon~~ all that was knowne /In geometry before\ &  
 advanced de Novo /with Exquisite clearnes and /~~...~~?\  
 exposing a cours of\ ~~laying open an~~  
~~Infi=~~  
~~nite Cours of~~ /farther to Infinte, In the most abstruse\  
 discovery ~~to such as have~~  
 /doctrine of curves, ffor y<sup>e</sup> benefit of such as have a Mind &\ Strength of genius to pursue it  
 could be  
 a ~~plagiary,~~ /stolen, be a plagiary and could charg this onely on acc<sup>o</sup> of\  
 and ~~this~~ /~~---~~?] ~~upon~~  
 an Idle  
 /old wifes\ Story of a frenchman /that Say\ - il l'a veus,<sup>245</sup> w<sup>ch</sup>  
 Its /well Enough\ knowne fforeigners are often disposed /Either out of complaisance\  
 /or [banter?]\ to Gratifie Such barbares (as they account  
 us) ~~with~~ by Nodding to their caprices. And

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<sup>244</sup> John Wallis (1616-1703), *A Treatise on Algebra*, 1685; Thomas Harriot (1560-1621) is now generally accepted to have been influential on Descartes' presentation of the equation, notation and in many other ways.

<sup>245</sup> i.e., 'he wanted it', see also f. 300r.

Many, If /(perhaps\ that Author ~~be-Not~~ /for\ one,) /have\ Swallowed  
it ffor Earnest.

It is most apparent ~~that~~ from cartesius ap=  
plying himself /with Such happy success\ both In his Geometry, & philo=  
sofy to the Notorious deffect's, and the despai=  
red discoverys of the ancients, that he was very  
conversant with & ~~understood~~ them; and was  
as nice a Crittiq In their Severall text's &  
the designes of them, as any What ever. I need  
Not Shew this out of his Geometry, ~~that in~~ /It is Enough declared\  
~~the~~ /there\ in y<sup>e</sup> Quere or p<sup>ro</sup>bleme of pappus.<sup>246</sup> but  
In his principles & philosophy [is is?] Not So Expli=  
cately declared, but yet discernable Enough  
to Such as will attend him. ffor the ancient's  
took the world as from Eternity, & Never  
Examined Such thing's as appeared plain  
to Sence. Cartesius found a way to Shew  
that the Same /naturall\ cours as maintained it  
might possibly be the means of bringing  
it together, w<sup>ch</sup> thought had Aristotle light  
upon, perhaps he had Not held y<sup>e</sup> Worlds E=  
ternity, Nor Set up dame nature for an  
Idoll to Excuse Ignorance of most ordinary  
thing's. The atomist's were forc't to Induc  
their particles with a tendency in vacuo

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<sup>246</sup> Descartes was sent Pappus' problem by Jacob Golius (1596-1667) in 1631



for giving a tollereable acc<sup>o</sup> of Gravity. And such Questions Aristotle despised, as If you asked why creature's /trees\ blossom, creatures generate w<sup>ch</sup> are say's he, by y<sup>e</sup> Guidance of Nature. and So for Quality's, a Most Miserable Shift to Say body's were Imbued with this and that Quality; that is, thus it is, becaus it is. Now Cartesius hath ffilled these blanks, by throwing /off\ all Quality's, and accounting for comon & celes= tiall phaenomena by the Same motive Neces= sity. He underStood well the frailty of hipo= theses, and used None where his Reason would serve. but in particular's that admitt No Experimentall test, he admitted an hypothesis since w<sup>ch</sup>, None hath bin attempted to Improve it, but the world despairing /so\ to doe it or to ffix on truth that way, have fallen Wholly to Experimenting. and cartesius himself decla= res against hypotheses, becaus as he Say's he Can by his owne Solve particular's divers way's and there can be but one truth. And so farr hath complied with the Infirmitie's of our Nature In assisting us with an hypothesis y<sup>e</sup> best, as he Could Contrive, /and Instituted according to a true Method of philosophy\ thincking it Some Eas, & serves/ing\ to avoid Sceptiscisme, tho he demands No one's assent to it, upon his authority.

I am not here wrighting a panigir or D. Cartes, ffor I know and Shall touch some of his failings. he was /really\ an hero, but Not omniscient Nor Impeccable in filosofy. But Reflecting what ~~contemptuous~~ Insults as well as slights ~~he is~~ are put upon him by men of academick Education /and Hierarchicall Interests\ as If he were an Ignis fatuus,<sup>247</sup> a Shallow ringleader of a vain sect, and those that opine with him are blind unthinking ~~but-obstinate~~ but obsequious party, I could Not forbear In this Intended discussion of authority's to doe him right, and Justify his In parity /at least\ with any /If Not Superior to all\ other Extant in y<sup>e</sup> World. and ffor that End I will subjoyne som Item's of Improvem /In filosofy\ Wholly owing to him.

1. His Giving So Easy and clear a Method to Imagin the Imensity of the world; for to hear of plurality or Infinite [words?], as was sometime thought among y<sup>e</sup> ancients did but amuse o<sup>r</sup> thoughts. Whilst Considering the Sun onely as a fixt starr, Governing & Illustrating the planets of this vast heaven wee Smoothly pass to y<sup>e</sup> beleeving that Each  
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<sup>247</sup> also known as will-o'-the-wisp

R. Authoritys.

little Starr, tho farther Removed from us yet May rule as Great a province distinguish't with as Many subjects. And If so wee Can Never reach y<sup>e</sup> Ends of y<sup>e</sup> World becaus wee know there are starr's beyond y<sup>e</sup> Most acute Sight, y<sup>e</sup> light of Some of w<sup>ch</sup> wee perceiv tho Not y<sup>e</sup> Body, from Whence it flows, as y<sup>e</sup> Galaxie, and others not perceived att all without Glasses, what limitts can be assigned,?

2. His Confuting the abuse of our senses In the foolish mistake of Quality's, and clearing us from their p<sup>r</sup>judices &c. and this with Such an ~~absolu~~ Exquisite decission of that puzzle made about y<sup>e</sup> Senses, Whither true or fals Informers, by declaring that the Error is Not in the Sences, but that those Ever Informe Exactly true, and that It is out judgm'<sup>t</sup>, and Inferences from them that prove fals.

3. The demonstrating that ~~the~~ Most operations in Nature are done by Insensible parts, the World being, as he holds ffull of bodyes.

4. That in the solution of appearances he Considers y<sup>e</sup> Compass of y<sup>e</sup> Whole Earth, What Reference it May have to or Influence from the celestiall Matter In w<sup>ch</sup> it is Conveyed. What power its Motion May have to the Severall parts of it, or one part of it to another; This is an admirable device, tho Not very perfect In him, being the first Inventor of it, but capable of vast Improvem<sup>t</sup>, were a good Naturall history & collection of Experiments had to Work it upon.

5. His advancing the principle of body and its Modes, or as they ordinarily speak, Motion, and Especially In one thing, that the union of part's is onely from Rest. this is one of his tenents w<sup>ch</sup> y<sup>e</sup> world despiseth, but Surely litel deserves it, as I may Shew anon.

6. It was a notable attempt, his venturing to give an acc<sup>o</sup> of the whole univers. viz<sup>t</sup> of the heaven's, how y<sup>e</sup> body of Every Starr might be generated. the reason of its Motion the boyling of the Maculor.<sup>248</sup> &c. When all y<sup>e</sup> world before was Content, as with a [lazy?] Discovery

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<sup>248</sup> i.e., 'sunspot'

T

## Authoritys.

discovery, to find out Even their Motion's.  
and Especially that of y<sup>e</sup> Earth; Epicurus  
pointed at it In some weak Endeavours  
In his meteors, but wanted Ingeni to goe on  
onely he Inculcates that there Must be  
some Caus for it, tho un knowne. And Why  
Should Not a Man Endeavour at an Explica=  
tion of those Magnalia, I know Not, When  
the psalmist Say's they have a law w<sup>ch</sup> they  
Cannot pass.<sup>249</sup> that is a Naturall reason, as  
any triviall thing here below.

7. His Rejection of finall Causes, In all Inqui=  
rys of Naturall things, for really It hath bin  
heretofore a great hindrance to the progress  
of knowledg, the thincking the whole univers  
made for y<sup>e</sup> use of Man. and Studying out y<sup>e</sup>  
conveniences onely in Reference to him; this  
hath caused great difficulty of beleaving  
Each planet an Earth as ours is; but altho  
wee have a dwelling here pleasant & com=  
modious Enough, It is Not to be denied but  
If our convenience onely had bin Studyed  
In y<sup>e</sup> placing y<sup>e</sup> Sun Moon & Starrs, they Might  
have bin disposed with more advantage then  
they are & In this Bacon & others Concurr With him.

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<sup>249</sup> i.e., 'those great things'. It is likely that the specific reference here is to Psalm 148, verse 6: 'He hath also stablished them for ever and ever: he hath made a decree which shall not pass.' (King James Version)

8. But above all his stupendious discovery of Motion. of w<sup>ch</sup> I Shall give a fuller acc<sup>o</sup> then of the rest, becaus it is Wholly his owne and is of the last Importance in all Naturall knowledg; It was In Effect this.<sup>250</sup>

That it was No reall thing subsisting in body besids it's Extension In longum, latum & profundum,<sup>251</sup> but Exists wholly in the Relation between severall body's with Respect to their posture and distance. Wherefore look upon any systeme or parcell of various body's apart by themselves If their posture and distance Continue with Respect to Each other, the Same. they rest; but If those chang, they Move, & /so may\ with all the variety, as they are capable to admitt, so as to denominate More or less, here or there. &c. But if one Single body is Considered In vacuo Imenso<sup>252</sup>, (Granting Such Were) So that there be No other body's to have relation of posture or distance with; all Motion & Rest is Nullifyed. And it is the Same with Every body separately considered in pleno, for as to all concernes of it, Motion & Rest, (creatures of Relation) are all one. and Nothing can be affirmed of a body as to its

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<sup>250</sup> It is important to realise that the following section, in which RN gives his own account of Descartes's 'laws of motion', is the very core of RN's physicks and metaphysics. Any understanding of what he means by the authority of science, or 'phisicks', to explain the world works from these assumptions. The notion of 'relation' shapes his epistemology (s well as his 'microcosmick science', or physiology/psychology, along the lines of Descartes account of the passions; see 'of Humane Capacity'), and results in an ontology, or explanation of what must be 'out there' (that is, given the limitations of human capacity to understand or account for what *is* 'out there'). Like Descartes, RN is not sceptical about the existence of things, only of our capacity to perceive them aright.

<sup>251</sup> i.e., 'length, breadth and depth'

<sup>252</sup> i.e., 'in an immense vacuum' (as opposed to the moving object in a plenum)

## W. Authoritys.

Essence or Nature, More in Supposed Motion, then Rest. And that force or action is Not ascribable to Motion More then to Rest, but Either State hath the same force of perseverance; and vis Inertio is as active as vis motus.<sup>253</sup> That the continuance of Motion after the Motive Caus Ceased, is as Rest, figure, or ought of essence or Mode, w<sup>ch</sup> is Extant, Can not chang from its state to another, without an Efficient caus; wherefore a body Moved can No More stop, then another Start into Motion, without a Sufficient caus; and that Not Intervening Either shall, as all other Exstances, Continue for Ever. W<sup>ch</sup> he proves from an axiom of Eternall truth, that Nothing can Make or unmake it self, **Ex Nihilo nihil fit, vel deficit**.<sup>254</sup> And that body May truly be say'd both to Move and to Rest as arbitrary Regard is had to other body's or Systemes of body. As the water passing the bows of a ship, It is all one /as to all exercise if y<sup>e</sup> Ship\ whither the Ship Sailes thro the water, or ly at anchor In the tides way. but goe to y<sup>e</sup> Shore, and one is Motion & y<sup>e</sup> other Rest. & Goe to the fixt starr's, and the former shall /may\ be Rest & the other Motion, as If the vessell sailes

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<sup>253</sup> i.e., the forces of 'inertia', and of 'motion'. 'vis inertia' was for Newton the tendency *not* to move, i.e., 'to rest'; RN has no notion of 'rest' in his cosmology as he here explains - all is in movement, and rest is only an appearance of rest owing to the relative positions of things.

<sup>254</sup> i.e., 'nothing is made, or unmade, from nothing' [?]

west just as much as the diurnall motion of the Earth setts her East. And If you could Extend y<sup>r</sup> view and Collate with ~~farther~~ ~~or~~ divers other & farther Systemes of body, yet the contrary (In our way of Speaking) Might be true. so that upon the whole, there is No absolute Motion, but all is Relative, and accordingly all thing's May be sayd to move or rest as that Relation is considered.

This is the Nature of Motion according to Cartesius, and is Received by the vertuosi, & becomes y<sup>e</sup> Standard of /all\ our Mechanick philosophy. there is one point, that of absolute motion distinguish't from Relative, w<sup>ch</sup> a latter author<sup>255</sup> holds, and will entertain us afterwards. I doe Not p<sup>r</sup>tend that this larg Explication of Motion here given is found /Expressly\ Either within Cartes definition or in any of his works, but one that run's may read it it was his sence, tho Not so Explicite as some would Expect.<sup>256</sup> the occasion of ~~some~~ /his\ disguising himself in this, was the Impertinence of y<sup>e</sup> Scools & accadamy, w<sup>ch</sup> held him in some aw, but More the Iron  
hands

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<sup>255</sup> That is, Isaac Newton, see below.

<sup>256</sup> RN is Decscartes interpreter as well as his defender. Descartes, in this account, could not speak his complete turth for fear of persecution, and thus requires RN to articulate his point of view within the embattled freedom of expression in Queen Annes' England!



## Y. Authoritys

hands of y<sup>e</sup> Roman Hierarchy. his designe of Establishing y<sup>e</sup> Motion of y<sup>e</sup> Earth Was Smelt and defyed Early. In other things the Italian's were Not avers to his philosophy. this Made him mumble y<sup>e</sup> Matter, and frame his definition with such art & Subterfuge, that he Might by p<sup>r</sup>serve his Notion, and yet Elude y<sup>e</sup> faction by p<sup>r</sup>ending to shew, y<sup>e</sup> Earth had really More of Motion after the old way, then his. If he had bin assured of his Safety, he had dealt More plainely, and thereby have given less advantage ag<sup>t</sup> himself, then by Mincing the Matter. His definition of Motion is, that it is the translation of body's from the vicinity of some to the vicinity of others, w<sup>ch</sup> are Esteemed as Resting. Which defenition plainely mean's that Motion Exists Wholly in the Modes of body's, as to posture and distance, Continuance whereof the continuance, is rest, and the Change, motion, In those that are so collated. M<sup>r</sup> Newton dissaproves this definition, becaus he Say's that Motion is absolute, & other's Quarrell the definition, becaus the tanquam [Quicseates?] is not positive, as the termes of definitions ought to be. but yet In the Maine this admirable thought of his as to Motion & Rest doth

Succeed. but that w<sup>ch</sup> Remaines is a Superla=  
 tive Improvem<sup>t</sup> of philosophy, vis<sup>t</sup>. he thath de=  
 monstrated that Motion is Regulated accor=  
 ding to the measure of Quantity; So that If the  
 State of body's Impelling Each other be given  
 the Consequent Effect of y<sup>e</sup> Impuls, on Either  
 is demonstrable. This Goeth through & through  
 and brings Naturall philosofy More within Geo=  
 metrick Method, then could other be Imagined.  
 I cannot Say doctrine of Impulses Came  
 perfect from him. ffor he was Guilty of Mis=  
 takes In particular Cases, w<sup>ch</sup> the latter Me=  
 chanicians have sett right, & Is best found  
 In M<sup>r</sup>. Newton. But After he had discovered  
 that there was a rule, If he had lett y<sup>e</sup> parti=  
 cular cases alone, the World Would soon have  
 produced them. I shall Instance but In one  
 point, he holds that In vacuo a greater  
 body doth Not Move a lesser att all, and  
 What Motion a lesser takes he thinck's is  
 from the Medium, but this is found contrary  
 to Experience, and will have place, In Cen=  
 among y<sup>e</sup> law's of Motion.

Now as to the failings of D. Cartes, this I  
 account one, I may Instance divers others

as

## A.a. Authority's.

Conatus ad Motum, his acc<sup>o</sup> of Colours In /from\ Refra=
 ction, His particula<sup>e</sup> Striata<sup>e</sup>.<sup>257</sup> and In generall, all
 his Hypothesis In the nicety's of particules, Such
 as the Anguillar forme of Watery parts, & Some
 others w<sup>ch</sup> I touch here onely passing, having
 more to doe with them In proper place. But this
 is to be Say'd ffor him that his failing's are
 Most in particular's that are without /beyond\ humane
 Scrutiny, and Not In the principles or the rea=
 soned part of his System; and he himself Com=
 plains, as I sayd, of his want of Experim<sup>ts</sup>, to
 Make good paticulars; and as to Hypotheses
 he disapproves them, & wishes for a body of expe=
 riments; So that he is sensible Enough of most
 objections to his philosophy, whereby it appears
 his defects are to be ascribed more to humanity
 In generall, then to his reason In particular.
 And his tenderness is Such as to Impose on None
 but by Recommending doubdting, lay's himself,
 open to Examination, & declines all authori=
 ty; then w<sup>ch</sup> Nothing Can More Recomend a
 teacher, Especially In philosophy. That he was
 lyable to the frailety's of oversights as well as
 overconfidence; and Shew's it More then once. as
 to his oversight's they were I sayd Most in
 particularity's, as his Cases of Motion, &c. wee
 may Consider that those were Not his Grand
 designe, but added for Explication, and perhaps
 not

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<sup>257</sup> see above , f. 29v.

not so well considered or at y<sup>e</sup> least proved  
 by Experiment. When the cittadell is Gained  
 there is less consideration of y<sup>e</sup> vaults & cellars  
 in it. And the content of the maine Conquest  
 made smaller party's despised, or look on  
 as submitting without trouble. As for his Con=  
 fidence, that is Not very Gross Nor frequent  
 as wee find it In other Great witts, who rise  
 in it to a pitch of Insolence, as is obvious to  
 all conversant in their wrightings; But D.  
 Cartes, by much thought Convinc't himself  
 and then It is Naturall to write with an air  
 of assurance, the utmost of w<sup>ch</sup>, as I have ob=  
 Served amounts but to this, that the Solution  
 is So Easy & naturall that, it is ag<sup>t</sup> reason Not  
 to Conclude it true, or /some\ Such assured Expressions.  
 As to his Method of doubting, It is, as I ob=  
 Served, but an artifice he had of subduing  
 his p<sup>r</sup>judices contracted In youth, & Early Studys.  
 And so farr Men /can\ find No fault with it, but yet  
 many fear /in\ bad Consequences ~~from it, & there~~  
~~fore~~, Whither reasonably or Not, affront it. M<sup>r</sup>  
 Rapon say's his first Step Cogito Ergo Sum,  
 is sum cogitans,<sup>258</sup> and trifling; but I know Not  
 why, for take it Either way Exprest, the thing  
 is the Same, a being sensible of it self, Must  
 Exist. And, Surely self perception is the first  
 & Surest

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<sup>258</sup> The argument is that "I think, therefore I am" should rather be: "I am something thinking". I have not been able to identify Mr. Rapon, but this play on the words is one employed by Baruch Spinoza (1632-77) in his *Renati Descartes Principia Philosophiae, More Geometrico Demonstrata* (*René Descartes' Principles of Philosophy Demonstrated Geometrically*), Amsterdam, 1663. The celebrated Latin phrase first appeared in the *Principia Philosophiae*, Amsterdam, 1644 (previously the 'cogito' had circulated in French, in the *Discours de la Méthod* (*Discourse on Method*), Leiden, 1637, as: 'je pense, donc je suis'.

A.c. Authority's.

and surest proof of Existence. and there being Nothing to uphold that proof, but onely that wee clearly & distinctly perceiv it to be true, Whence he argues that what wee clearly & distinctly perceiv is true, vis<sup>t</sup> that wee perceiv it: tho it follow's Not, that our opinions thereon are true; but /on y<sup>e</sup> contrary it is\ ~~they are~~ found /they are\ for Most part fals; others have say'd that he doubdt the axiom's, so Equalibus addus Equalia<sup>259</sup> &c. least some power hath a designe to cheat him, tho those are as distinctly & clearly perceived to be true, as his owne being. But it Must be considered those make a step farther, for it must be concluded there are other being's besides himself. Many disallow his demonstration of a diety from the Idea w<sup>ch</sup> he say's Is Innate.<sup>260</sup> & Could Not forme it self, Ergo &c. as Not Concluding. perhaps they doe Not Consider that this Is the ffirst attempt from pure reason, all y<sup>e</sup> argum<sup>ts</sup> from y<sup>e</sup> world apart, to prove a diety. and the Expression's May Not be so Well adjusted, but men May take them with some deference of Intellection. As If wee Examine What what that Idea is, It will be found In truth to be onely /an Idea\ of our owne /wants &\ Imperfection, ffor its plain want's are familiar Even with Infants. and what is y<sup>e</sup> Idea of Want or defect, but that of the alternate, Supply, and Injoyment, w<sup>ch</sup>

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<sup>259</sup> i.e., 'the same adds up to the same'

<sup>260</sup> For example, John Locke (1632-1704)

must goe on gradually to perfection, & that terminates In God? And proving that Even Infant's new borne are sensible of a better being, they are sensible of a God, tho Not with all the advantages of reasoning so as to Introduce y<sup>e</sup> Attributes, untill Reason & Memory are ripe to digest & Retein the acquired Steps. Then the [Magneno?] of understanding that Battell's Innate Ideas, we Must Grant that No formed Image Enters but by sence;<sup>261</sup> but what is that but difference of y<sup>e</sup> Sence taken of the words. by Innate Ideas, he Mean's formed Images, Such as wee have & generally Invested in language, w<sup>ch</sup> is a memoriall of them to us. and Cartesius Mean's No such thing, but that, as Men are Sensible of them Selves, w<sup>ch</sup>, according to him, is an Inate Idea, & I thinck y<sup>e</sup> other Will Not deny it; So Men are Sensible of their own defect's; that is life & desire are coetaneous. And Reflecting on that desire, w<sup>ch</sup> as Cartesius holds, did Not forme it self, wee from an Innate principle Must of Necessity Conclude in God, as the former of us and our desires or Naturall appetites. I desire to know what philosofer In y<sup>e</sup> world Ever, as Cartes Sent his Meditations abroad to challeng objection's In order to Regulate /as well as [falsifie?]\ his owne

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<sup>261</sup> Following his assertion of infantile self-consciousness as a warrant of an innate idea of God (contined further down the page), RN turns to address Locke's refusal of innate ideas. I have no idea, innate or otherwise, what the word 'Magneno' is; I'll keep trying. It must (it seems, from an innate premonition, as well as from the context) be a humourous term, typical of RN's sarcastic rhetoric, to suggest John Locke as a 'great one'.

A.e. Authoritys

Sentiments, and In subjects of originall thin=  
king;<sup>262</sup> It is an Instance without Example; and  
however I am Not a Cartesian /in y<sup>e</sup> sence of the academicks\ so as ~~to~~ I do=  
/blindly to Idol\lize him, but /am Glad as [those men?] (that with more [...?])\ ~~content~~  
[...?] to use him, I ~~must~~  
/I cannot but\ conclude that however Short he fell of being  
Equall to all his undertaking, the best of  
philosofer's came /as much\ short of him.

Now I might give a Catalogue of the Ill usage  
this deserving Author hath had, ffrom the gene=  
rality of filosofick professor's, who to say truth  
In Most that's Good In them are but his pla=  
giary's, but it will Swell /too much\ for the profit it brings.  
lett the theoria talluris sacra,<sup>263</sup> be noted for one  
a thought Such as it is, meer Cartesian. and yett  
not a good word of its author, but y<sup>e</sup> Contrary.  
so of the other's In y<sup>e</sup> Same sequell, not worth  
naming. M<sup>r</sup>-Leek; The humane understan=  
ding, another tree Sprang from a Cartesian  
root. ffor what rule of verity is there but  
the clare Et distincta'<sup>264</sup> of Cartesius, and yet  
stalk's on with a sort of contemptuous  
sneer at the founder. these are Men by Spin=  
ning fine Webb's, out of other's bowells, thinck  
the fly's cacht are all their owne. I shall Men=  
tion No More, tho divers press but hast to the  
Noble author of the principia, who to give  
him his due, is the onely person Since Cartesius  
of a

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<sup>262</sup> RN expresses an argument in favour of Descartes in almost identical words to those used in the 'p<sup>r</sup>fando' (BL Add MS 32526, f. 2r), which is dated by Miller and others to the mid-1690s. This is, however, I think a much later text.

<sup>263</sup> Thomas Burnett (1635-1715), *Telluris Theoria Sacra, etc.*, (first Latin edition) London, 1681.

<sup>264</sup> i.e., 'clear and distinct'

of a genius /In y<sup>e</sup> way of natural philosophy\ ffitt to be Compared with him.  
 And I thinck I shall doe him No wrong In Ma=  
 king the Comparison, ~~w<sup>eh</sup> I doe as~~ /tho like\ plutark in  
 his lives, not for parrallell, but opposites /vertues\ w<sup>ch</sup>  
 layd together ~~often~~ /best\ Shew Each other;<sup>265</sup>  
 And If I doe Not p<sup>r</sup>ferr him, he May Excuse it,  
 becaus he came after y<sup>e</sup> other who had pos=  
 sest the larg plaines of discovery before him.  
 And for that reason perhaps occasioned him  
 to Study New tracts, rather then follow /those of D\ Cartes  
 /This ~~Granted~~ if it be So\ ~~w<sup>eh</sup> is~~ No More then Aristotle did before him,  
~~that~~ /who\ to overturne the ~~defect/ive~~ /Imperfect Systemes\ of y<sup>e</sup> ancient  
 Naturalist's, patcht up a device /of his owne\ Not from  
 Nature /things\ but thoughts & thereby /out of a [clever..?]\ got A /contrivance\ turne<sup>266</sup>  
 & Amortized y<sup>e</sup> ~~Rest~~ all the more rationally ~~So=~~ /Hypothesis\  
 lution's of y<sup>e</sup> others. And In this Respect I must  
 Needs Complaine of the unhappyness attends  
 right & truth in y<sup>e</sup> World, ~~that~~ /w<sup>ch</sup>\ like Garments  
 it Seem's to wear out, & Call for Novelty ~~w<sup>eh</sup>~~ /and that\  
 /[o?]f one sort or other\ tho Never so Shallow, & falls /in process of time is almost [as?]  
 sure to\ Shall, p<sup>r</sup>vaile,  
 as If Men thought the vertue of philosophy con=  
 sisted in fame & Not In truth, and ~~that~~ the  
 latter were ~~but~~ a /to be of use onely for\ p<sup>r</sup>tence as the poor publik  
 is Made to subserve private & ambitious Interests.

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<sup>265</sup> Plutarch's Lives are laid out in pairs, thus they are known as the 'parallel lives'. Twenty-three pairs plus four unpaired single lives survive from antiquity. Each pairing employs a comparison, bringing together a Greek and a Roman example of, say, an orator or general; the comparison turns upon shared or contrasting faults or virtues. The first translation of Plutarch's Lives into English (it was actually translated from Jacques Amyot's French translation of the Greek, *Vies des hommes illustres*, Michel Vascosan, Paris, 1559) was made by RN's great-great-great uncle, Sir Thomas North (1535-1604), and published in 1579, revised in 1595. This edition carried over Amyot's celebrated literary bravura, and served as a source for Shakespeare's Greek and Roman plays. The first complete translation of all the Lives into English from the original Greek was done under the editorship of John Dryden and published in 1683.

<sup>266</sup> I may be doing the same thing here, amortizing the rest, but this is the best reading I can get of a very over written passage. It is clear what the general point is.



Ag. Authority's.

first In generall It appears that Cartesius aimed to Make his philosophy as communicable to the Capacity's of all Mankind as was possible and therefore he discovered his Mind au fonds<sup>267</sup> and was so far from Concealing, that rather out went him self, & his owne Judgm't, as he Confesseth, In Hypothetick Conjectures, then leav any thing dark, w<sup>ch</sup> he thought [be?] in the least Explained, /And for this reason he used no Experiment in all his philosophy only [of?] things of comon observation\ But Mr. Newton on y<sup>e</sup> other hand keeps himself all in the dark, so that it is Impossible from his wrightings to Collect his Generall sence. He is an Inventer of most admirable ~~ob~~ /notions\ about light, and Colours and /all\ Opticall ~~Exper~~ /matters\ ~~And As that light {or?}~~ /as for Instance y<sup>t</sup> Rays of light are of various colours, Specifically distinguisht & White is an aggregate of them all blended together. but when they Come to Refract some being /in their Nature\ Refrangible to Greater angles the others, as red more then blue & that More then yellow & the like, ~~when it happen's the surface of y<sup>e</sup> Medium Refracts them~~ they are distinguisht by separation. But this doth Not att all content the Spirits; ffor What Matter's how the Colours happen to appear, If wee know ~~Neither~~ /Not\ what /Either\ light & Colours are. It is just as If one discernes a /small\ light Shine, and one to give him the ~~reason~~ /philosophy\ of it, shews him y<sup>e</sup> [Side?] it Comes in at; It is just as Aristotle  
for

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<sup>267</sup> i.e., 'at bottom, fundamentally', from the French

for comon objects, as Gravity, levity, vege=  
 tation. &c. say's It is the Nature of them.  
 I Grant it is very Ingenuious, but Not philo=  
 sofically;<sup>268</sup> The Glorious Barrow<sup>269</sup> had a thought  
 by w<sup>ch</sup>, he demonstrates opticall propositions  
 vis<sup>t</sup>. that Ray's are Solid /Rectangular paralepipedons\, and falling obliq  
 pitch upon an angle, and so Are diverted  
 from their Cours. this is also Ingenious, and  
 worthy a Mathematition, who Must have  
 measurable data, that is body & y<sup>e</sup> Modes of  
 it, or he doth Nothing. but It is farr ffrom Sa=  
 tisfying an Inquisitive Mind. Now Cartesius,  
 hath Given a Generall Caus of light, w<sup>ch</sup> is  
 beyond all those limitaneous fetches; I will  
 not debate the justice of it, here Intending it  
 a place in another Essay. but Whatever y<sup>e</sup>  
 Event is, the atempt is More Generous, &  
 heroick the any of the Rest.

One would have thought that after Cartesius  
 wee Should have heard, Neither of vacuum  
 Nor if Quality's any More, Especially the latter  
 w<sup>ch</sup> is a Meer cover of Ignorance, and is but  
 vox Et preterea Nihill;<sup>270</sup> for what doth he Say  
 that tells us that heavy thing's fall by an=  
 Intrinsick Quality? As for vacuum that is  
 More at pleasure, becaus it is almost Impos=

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<sup>268</sup> This is a strange cavill about Newton's discovery. The point is that for RN Newton has done no more than describe what is there rather than explain how it comes about - thus contributing to natural history rather than natural philosophy.

<sup>269</sup> Isaac Barrow, 1630-77, was at various times (and with interruptions) Regius Professor of Greek at Cambridge, Gresham Professor of Geometry and fellow of the Royal Society in London, and (first) holder of the Lucasian Chair in Mathematics at Cambridge which he resigned in 1669, to be succeeded by Isaac Newton. He was Master of Trinity College, Cambridge, previous to RN's brother, John North. Barrow's theory of light (to be found in the *Lectiones Opticae et Geometricae*, 1669), is in conflict with, though produced in creative tension with, that of Descartes. See: Feingold, M. (ed), *Before Newton. The Life and Times of Isaac Barrow*, Cambridge University Press, New York, 1990. Throughout the MSS RN uses the mathematical notation recommended in the prefatory materials to Barrow's *Lectiones opticae et geometricae*.

<sup>270</sup> i.e., 'Voice and for the rest, nothing' (more usually: 'vox et praeterea nihil'), a quote from Plutarch's *Moralia*, found in the *Apophthegmata Laconica* (The Sayings of the Spartans).

## A.i. Authority's.

sibe to demonstrate one way, or other. but  
the other is so Gross, It is strang it being once  
Exposed it Should Gaine Ground againe. but  
[Curisosity?] is as /no less\ pleased in ~~finding~~ /at\ Matter of Won=  
der /If new\ tho Not understood, ~~If New~~, as /at\ matter of  
plainest reason, w<sup>ch</sup> /that\ once pointed to, is obvious.  
Cartesius disbanded all the Quality's of the old  
philosofers, and Establish't the Energy of body  
In Motion, to account in their room for Every  
thing. But M<sup>r</sup> Newton hath Erected a most  
Exquisite structure as to ~~the~~ Ingeni & demon=  
stration In y<sup>e</sup> Conduct of it. but Setting aside /y<sup>e</sup> laws of motion w<sup>ch</sup>\  
~~What if taken~~ /are derived\ from Cartesius, it is all built u=  
pon Quality's. ffor there wee have the centri=  
petall & centrifugall Quality's, and body's  
attracting Each other, with force deminishing  
by the squares of their distance. And that at=  
traction, Made to Solve all the Mundane  
systeme, Gravity, levity &c. I blame Cartesius  
In this, that he Made So Much use of the  
comon Experiment, of thing's turning loosed  
w<sup>ch</sup> goe off in a tangent, & Reteined recede  
quantum in illis,<sup>271</sup> from y<sup>e</sup> center, and yet did  
Not Enough Explaine how & from what prin=  
ciple such regularity of Recess was derived; but  
Exposing y<sup>e</sup> Experim't the thing was plain. this  
was y<sup>e</sup> Same failing, So Much observed in y<sup>e</sup> ancients,

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<sup>271</sup> i.e., 'so much as is in them', i.e., proportionately

Who Saw No wonder in What was Comon.  
 but /to\ find So Much straining & paines taken  
 as In y<sup>e</sup> principia, Such Expence of witt & thought  
 and all upon principles assumed but Not under=  
 stood /and in y<sup>e</sup> main fals\ ~~Strang to Me~~. In a work, that hath  
 philosophy In y<sup>e</sup> Style of it, was Wonderfull to Me.  
 I sayd fals, ffor that body's attract Each other  
 at all, I may affirme to be so, beleiving that  
 it is demonstrable by Experiment.

As other Suggested in y<sup>e</sup> principia, is to My Sence  
 Most Extravagent. the author Supposeth the pla=  
 net's to live in vacuo Imenso; and yet these  
 Influences of light, attraction, centripetall &  
 centrifugall vertues operate thro this Imens  
 vacuum. I would fain know how body's can  
 Attract one and other, when vacuum is between  
 'em. ~~What~~, the place /it seems\ is filled with attraction, then  
 It is Not vacuum; but ~~it~~ /Attraction\ is Not body; ~~What is it?~~  
 can that w<sup>ch</sup> is Not body, Move body's? or  
 what is this attraction: I Grant y<sup>e</sup> Author is  
 Sensible of these Inquiry's at first, and Say's  
 he is to Give Mathematicall demonstration  
 and craves No phisicall Solutions may be  
 Expected, but Such Energeticall attraction /supposed\  
 as he useth. but then In the process of his work  
 he

Am. Authoritys

he falls to Systematizing y<sup>e</sup> world, on this principle off attraction with all the assurance as might be Expected ~~from clear~~ /were it done upon clear & Not [p<sup>r</sup>carious?]\ principles /And all on no better argum<sup>t</sup> then shall all phenomena agree,\ These are Such flaws, that the Manifest a=  
 bility of the Author, doth Not permitt me to thinck otherwise, but that he Reserves to him=  
 self, Some Systeme of phisicall knowledg, that he thinck's highly probable, and but cannot to his satisfaction demonstrate his opinions, so ~~that he May~~ /as to\ be secure ag<sup>t</sup> ca=  
 vills; And the Example of Cartesius In this may Make him beware. ffor y<sup>e</sup> world is Spight=  
 full; and If there be lacune, the Envious will assuredly peck-there.<sup>272</sup>

But one thing I am less Reconciled too, & that is his /seeming [...?]\ content, In opposing cartesius, ~~for~~ to whom, tho both his very profession of demonstrating Naturall appearances, More geometrico, but the laws of Matter, & Mo=  
 tion, on we<sup>ch</sup> the strength & hon<sup>r</sup> of his peice depends, are owing to cartesius, he gives No good Word, or frendly Respect, as cartesius doth to inventor's before him, & particularly Harvey about y<sup>e</sup> Circulation of y<sup>e</sup> blood.<sup>273</sup> ffor In More places then one in his book, the Conclusion comes, that this or that of Cartesius, & particularly  
 his

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<sup>272</sup> RN may indeed have believed that Newton had secret proofs he dared not share, but it is more likely that he was employing irony here.

<sup>273</sup> Descartes pays respect to William Harvey ....

His vortexes doe Not hold water Explicate the  
 celestiall phainomena. W<sup>ch</sup> looks as If the  
 Whole designe & study of his book were to  
 overturne Cartesius philosophy, w<sup>ch</sup> is So ad=  
 mirable, & I thinck In Expagnable, In the  
 Grand disposition of y<sup>e</sup> Mundane Systeme.  
 When wee See, with What facility vast body  
 goe along with fluids, being librated in them,  
 Without any Concussion's Expensive of Imme=  
 diate force, If Such were to be applyd; as  
 Shipps, and (as y<sup>e</sup> ancients thought) Ilands in  
 a Current of Water. And then that there  
 Should be a roling of y<sup>e</sup> Mundane fluid  
 about y<sup>e</sup> Sun, In w<sup>ch</sup> these lumps Called pla=  
 netts hang poised by Gravity in or Near y<sup>e</sup>  
 distance they keep /and So are Silently borne about\:  
 What is so credible?  
 I account this /[onely?]\thought of is /amounts to\  
 demonstrated.  
 /Such hold it takes of our assent.\ And No Subtile  
 Invention's what ever Shall  
 Remove this placid familiar account of, this, as  
 hath Not bin yet done, &, as my faith at pr=  
 sent is Never Will. Nor doth this cross that  
 w<sup>ch</sup> was say'd of fitness, being no argument  
 of an hypothesis. ffor severall Hypotheses  
 may

Ao. Authority

May Equally ffitt, and y<sup>e</sup> one be In No sort conformable to the rest of Nature. as What was there In y<sup>e</sup> Sensible world to Countenance Solid Orbs & Epicycles? and yet those ffitted y<sup>e</sup> use of Calculating y<sup>e</sup> /ancient? \ phenomena of the heavens. So What's there of Experiment /to\ Cōū Countenance an universall principle of attraction? And yet, that, as M<sup>r</sup>. Newton Shews, solves (nearly) the phenomena of y<sup>e</sup> planets. And /yet\ becaus they /beth\ are so various from the Comon Cours of thing's wee Meet & know, there is Reason to Reject them both. It is Not So With the vertues (If I may use a p<sup>r</sup>judicet Word) Since we find all thing's In our view & Comprehension performed in like Manner. That vast body's must have as vast to Move ~~them~~ or Stop them, but /poised\ In fluids Great & Small are Imprest alike. fluides wee find In /by\ air & Sea, are perpetually rolling about, why Should /that of\ y<sup>e</sup> heaven's ~~stand still~~ Stagnate? or Why May Not planet's, In that as broken Shipps, In y<sup>e</sup> sea float about, after the Ca= price of it? Wee prove heavy body In a /certein\= depth shall /may be so poysed as to\ have No weight, but /put\ higher ~~rise~~ /sink? \ & lower rise to y<sup>e</sup> pitch, & so would Eternally

Remaine as the planet's In like Manner  
 remaine /Indefinitely and so Ever\ following the flow of y<sup>e</sup> Medium.  
 This is Not /a\ ffitting, So as serving onely to ans<sup>r</sup>  
 Question's, as y<sup>e</sup> /w<sup>ch</sup> with y<sup>e</sup>\ ancient Hypotheses /served y<sup>e</sup> turne\. but with  
 conformity /also\ to y<sup>e</sup> generall Cours of things in  
 the /Sensible\ world, out of w<sup>ch</sup> /often Springs\ riseth an arguments  
 of probability So Strong, and particularly of  
 to this the Mundane System, as to border Neer  
 upon Experiment demonstration.

But here I may be told that this aventure /great un=  
 dertaking to Solve the phenomena of the hea=  
 ven's, More geomatrico, is So great an advan=  
 tage to philosophy, as there will be reason to In=  
 troduce it, In all Sorts of Solutions, and admitt  
 None but what Shall lean Either upon de=  
 monstration or Experiment. I say, It were very  
 well If It could be so, and /that all\ argument's of pro=  
 bability should /might\ all be layd aside, as Not conclu=  
 ding. And In some cases I admitt there is No  
 admittance but upon termes of Rigorous de=  
 monstration. And that is In all these subject's  
 that fall within the Mathematick Sciences.  
 W<sup>ch</sup> are onely Such as consist In comparison  
 of body's, or w<sup>ch</sup> is y<sup>e</sup> Same thing, the demen=  
 sion's of body's. Where the operation's of  
 addition



Aq. Authority's

Addition Subtraction Multiplication and division  
 May be practis't. and therefore, as was Sayd, to In=  
 stitute this Method, the principles Must consist  
 of knowne Quantity's, to be So wrought. but When  
 wee have Not our Subject matter delivered to us  
 In knowne Quantity's, the p<sup>r</sup>tence of demonstration  
 is vain. And that will fall out to be the Case  
 of Naturall philosophy, In all points but that of  
 the laws of Motion, w<sup>ch</sup> being found to accom=  
 pany, fall under like demonstration's with that,  
 & so treated is Called Mechanicks, such as the  
~~mechanick powers~~ /statick powers\. &c. the rules de Insidentibus  
 humido, & Such like. but In those Grand Spaces  
 of the heaven's there may be Ingredient's from  
 causes wholly latent from us, that the princi=  
 ples of ~~their~~ Movem<sup>t</sup> there, Cannot be demon=  
 Strated, untill Men Can demonstrate ~~what~~ /thatt they know all\ y<sup>t</sup> is  
 done in y<sup>e</sup> Sun or orb of Saturne, among y<sup>e</sup>  
 minute particles of y<sup>e</sup> Ether there. therefore the  
 assuming Centrall powers was a /peice of\ Mathema=  
 tick skill, but farr from a filosoficall aim,  
 w<sup>ch</sup> in thing's out of our reach, by Collation with  
 other thing's In our view & knowledg ffinding  
 Inductively agreem'<sup>ts</sup> & analogy's, Concludes  
 with sufficient probability, & Comands our assent,  
 And If men are Not pleased to admitt this  
 method

Method they Must lay aside a Science w<sup>ch</sup>  
 Exercises the faculty's of men, In Judging y<sup>e</sup>  
 beauty's of the Creator's works, More then all  
 that there is besides.

I would Not appear to argue ag<sup>t</sup> the Mathe=  
 matick sciences, w<sup>ch</sup> I admire, & envy In Such  
 as are Capable to Comprehend vastly beyond My  
 Capacity. but I must Say, that Some branches  
 of knowledg doe Not appertein to them. Not to  
 Mention theology, Morality & policy, (In w<sup>ch</sup>  
 some pamphleteerish writers usurp the word  
 demonstration Improperly & Impertinently,)<sup>274</sup>  
 Regard /but\ Meerly /y<sup>e</sup> Science of\ phisicks, and the Greatest part  
 of it, must and will consist, as to our skill,  
 In probability's, and that in Severall degrees  
 of More & less, so as to Confine upon but Not  
 Enter the lines of demonstration. As for Instance  
 thing's that Consist In Event, & Not in Quan=  
 tity. As that the Sun Shall rise; wee beleev  
 & would wager high it will, but it is Not  
 (striktly) Certain. So for all the Event's of  
 Motion. wee argue from similarity of causes  
 Similar Effects, w<sup>ch</sup> is true Enough, but who Can  
 prove y<sup>e</sup> caus, or Examine y<sup>e</sup> Effect bu so as  
 to be certain of Either. and yet there is Such  
 a

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<sup>274</sup> It might be that RN has a specific work in mind. The word 'demonstration' in the title of polemical literature was frequently used, especially in relation to argument in religious matters. There was, if anything, a reduction in the frequency of its use from the 1680s onwards when the word became (perhaps) more closely associated with the use of experiment to prove a scientific point, rather than the presentation of an argument before the people (its original, 'etymological', meaning). This can be judged by searching for the word in the catalogue of titles held, for example, in the British Library.

## Authority's

a Constancy of proceeding, as one might boldly  
 affirme upon any case, a little More, or less;  
 but Not demonstrate; and Such are the Effects  
 of the Collision of body's, in w<sup>ch</sup> Mathematicks  
 doth tollerably well, because the data are all  
 In Measure. nay a Sceptick may say tho In  
 this /it happens so\ yet in other Instances, ~~like Causes shall Not~~ /it May happen otherwise\  
~~have like Effects~~ /becaus there may be\, occasion's Imposible to be dis=  
 cerned. But in No other branches of Naturall  
 philosophy, w<sup>ch</sup> hath /have\ to doe with Mixtures, Where=  
 of y<sup>e</sup> Item's are unaccountable, demonstration  
 hath No Jurisdiction.

The Next thing & I thinck y<sup>e</sup> last under this  
 head, I Intend to Consider is Experiment. It is Most  
 certain all New philosophy leans on Experiment,  
 and that deservedly demands the greatest of  
 Authority's. But this ~~Notion of~~ /word\ Experi<sup>m</sup>t hath  
 various significations with divers sorts of people,  
 ffor Some account that Experi<sup>m</sup>ts are /numerous\ Costly things  
 w<sup>ch</sup> Every one hath Not at Comand. [0?] If wee  
 must stay for philosophy till that buisness is  
 done, we may stay long Enough. and others  
 are Not for Medling with philosophy till the Col=  
 lection of Experiment's Is Made, where out to  
 collect a compleat body of phisicks up on a  
 Surer

Surer foot then hath bin hithertoo. and others  
 thinck that the ordinary occurrences of life,  
 to one that hath a Sagacious Sence to observe  
 affords foundation Enough to guide y<sup>e</sup> Judgm<sup>t</sup>  
 In all generall's of philosophy. ffor the knowne /& allowd\  
 proof in phisicks is what they call Induction,  
 w<sup>ch</sup> is Many Instances pro, & None Contra.  
 and Infinite Experim<sup>ts</sup> can argue No more,  
 So If that be Sufficiently argued already by what  
 daily occurs to us What Mighty Necessity  
 of such multifarious & nice Experim<sup>ts</sup>, that are  
 Sought for. wee See Cartesians used onely a  
 childs sling with a stone in it, to Resolve  
 the Important case of Gravity; and the two  
 cross fingers upon a button, to shew the maner  
 of the Senses Entertaining Externall objects.  
 so the water In y<sup>e</sup> Wine press /fett\  
 directed to y<sup>e</sup> foraming by y<sup>e</sup> Neerest Cours, to Shew how light  
 Might pass thro the grosser Matter. and the  
 blind man's Staff to Shew, the Instantaneous  
 Judgm<sup>t</sup> of thing's, by remote touch, ~~to Shew y<sup>e</sup>~~ /as is done in\  
~~possibility of y<sup>e</sup> like upon vision,~~<sup>275</sup> but /yet\  
 In particular thing's wee often Need Experim<sup>ts</sup>, ~~but~~ /w<sup>ch</sup> are\  
 Such onely as are /occasion\  
 Suggested/s\  
 occasionally, and Not a Maze or  
 hudle of trick's as some aime to Make, w<sup>ch</sup>  
 ffeew or None

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<sup>275</sup> These 'experiments' (or rather, demonstrations - or even, given their function in  
 Descartes' and RN's rhetoric, illustrations and parables), are all used by RN, though not  
 each time credited back to Descartes, in his various essays.

A.u. Authoritys

few or none will look over, Especially If kept  
 In private Registers. The path is so beaten Now  
 by ye Chimists, that ye studious world /from chemicall books\ hath  
 Insight Enough, ffor /ye porpose of\ philosophy Into pyroteck=  
 ny, wh<sup>wch</sup> art is /really\ the cheif ~~resort of Exp /shop~~ Nurs of\ cri=  
 ticall Experim<sup>ts</sup>. And to goe beyond what artists  
 have already advanced, will Not be possible  
 but for profest chimists, and what vertuosi  
 can lay aside all his studdy's, & sacrifice  
 himself, & his Mony to that art In hopes (&  
 thos small ones) of discovering Somewhat /new & considerable\ .-  
 and after all If it be Not Some Gross surpris=  
 sing Effect, such as Gunpowder, & ye other  
 explosions, /and\ the torricellian ~~barat~~ vacuum.  
 & ye like but depending on ye Nicety of Weighing  
 in & wei out /ye Error of ye Work & computation may be so great y<sup>t</sup>\ the Experiments profits  
 little  
 In philosophy. That w<sup>ch</sup> is Reaped consists  
 more in overturning vaine Hypothesis, Such  
 as the 4. Elements and the chimists principles  
 w<sup>ch</sup> is done with that /Effect & \ clearness by Mr. Boyle  
 In his scepticall chimist,<sup>276</sup> /from thence, and other of his Remarques\ that I esteem him  
 the demonstrator (tho Not ye Inventor,) of  
 Corpuscular philosophy.

As the world in all its Motions, is apt to pass  
 from one Extream to another, so In this Matter  
 of Experim<sup>ts</sup>. for Many ages all philosophy  
 run

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<sup>276</sup> Robert Boyle's *The Sceptical Chymist: or Chymico-Physical Doubts & Paradoxes, etc*, was published by in London by J. Cadwell, in 1661.

run all upon /Either\ Similitudes or authority's  
 ffor if /a\ thing less knowne Could be made  
 like to a thing more knowne, or less fre=  
 quent to More frequent it was solution  
 Enough, tho Neither were understood. Such  
 was answe<sup>r</sup>, as to weeds thriving more then  
 flowers, making y<sup>e</sup> Ground as Mother to one  
 but Stepmother /onely\ to y<sup>e</sup> other; of this Stuff Much  
 is to be found among y<sup>e</sup> ancient sages;<sup>277</sup> but  
 afterwards they Came to chime in with y<sup>e</sup>  
 authority of Aristotle, that before lusted  
 themselves ~~under~~ /in\ divers /other\ sects, but None y<sup>t</sup>  
 I can find p<sup>r</sup>tended to Experiment such as  
 wee use, and If they Referred to naturall  
 & ordinary occurences it was by y<sup>e</sup> familia=  
 rity of them to Make others less /comon appearances\ strang. ffor  
 as I Sayd, they took generall affection's In  
 Nature for principles. But so soon as the  
 world found that the philosophy in vogue  
 was fals; as Nill Gravitat in Suo loco. to  
 Explaine y<sup>e</sup> ballance of fluid body's. w<sup>ch</sup>  
 occasioned the rediculous Experim<sup>t</sup> of weigh=  
 ing water with & without fish in it. Iris Est  
 Reflectio Solis In Nube Concava.and  
 most of y<sup>e</sup> parapatetick Maximes,<sup>278</sup> too  
 fulsome to Extract & set downe. they  
 could

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<sup>277</sup> This is a story told of Aesop's wisdom; when asked why weeds flourished and cultivated plants did not, he replied that Nature was the mother of weeds, but only the stepmother of cultivated plants, so she naturally tended more to her own.

<sup>278</sup> In Aristotelian/peripatetic thinking: '*Nihil gravitat in suo loco*' (that nothing in its proper place has weight) suggested that gravity was the tendency of things to move towards where they wanted to go (see note on f. 50r), and that having got to their proper place, they were no longer subject to gravity. '*Iris Est Reflectio Solis In Nube Concava*' (that the rainbow was the sun's reflection in a hollow cloud) was the explanation of refraction.

Ax. Authoritys

Applied to Experiments as the onely wea=  
pon against ~~the~~ this Tyrant in possession  
Authority. ffor what can In a promiscu=  
ous audience, be opposed to the Credit of  
ages, but direct try all, and that will Con=  
front all mankind. So that the New phi=  
losofers appealed to Experiment as the  
Reformers did to a generall Councell, as  
they thought an authority superior to those  
w<sup>ch</sup> opprest them.<sup>279</sup> And herein they were in  
the right, for dispute, an y<sup>e</sup> chiccan of w<sup>ch</sup>  
old philosophy leaned, vanish't, Issue was  
Joyned, & a verdict d by try all decided all.

This Notorious benefit of Experim<sup>ts</sup>, When  
y<sup>e</sup> world was Inclined to Chang, put them  
so Much in credit, that Ever since Nothing  
is talked of but Experiment, and socie=  
ty's are founded for y<sup>t</sup> End, their Motto  
Nullius In verba.<sup>280</sup> the designe to Make  
such a body of Experim<sup>ts</sup>, as Shall serve  
to ~~found~~ build a fabrick of Naturall phi=  
losofy, w<sup>ch</sup> /such as\ time Shall Neither Improve Nor  
destroy. I must Confess If there were y<sup>e</sup> Same  
zeal In the carrying on these designes /as first promoted y<sup>e</sup> Institution\ Great  
benefit might be had, & considerable disco=  
very's made. but after y<sup>e</sup> chang for w<sup>ch</sup>  
Experimentall philosophy was cryed up, is  
made

---

<sup>279</sup> Again the parallel of the Reformation and the 'fall' of Aristotelian authority. Which reformer succeeded by appeal to Councils RN does not make clear - John Hus was unfortunately burned at Constance, although concessions were gained for the Bohemian church; Lutherans had more sense than to go to Trento.

<sup>280</sup> Famously, the motto of the Royal Society, although the quotation is from .....

is Made & settled, the proceedings of these  
 Incorporate Society's flagg, and the rea=  
 der's, & p<sup>r</sup>sidents places, goe by favour  
 and their performances, meer lip-labour,  
 the publik Revenues turne to private uses,  
 the Solemne meeting's, for conference In  
 matters of philosophy, spent in wrangling  
 about their severall cheats, and ~~In Short~~  
 In Short the whole Integrity & use of the  
 society Corrupt & lost. And the ~~condu~~ affair  
 of Experimenting left to the disposition  
 of private person's. If Besides I thinck it  
 Impossible to Experiment an history of  
 nature, becaus very Important doubdts have  
 no way of access to them that wee know;  
 And Invention's of use, have Ever Come from  
 particular men, & Neither from universitys  
 Colledges, Nor society's. and w<sup>ch</sup> is More by  
 meer chance, looking for one thing find a=  
 nother. And Nothing is So tedious and un=  
 comfortable, as the putting agent's & pa=  
 tients together, and Nothing Extraordina=  
 ry come of it, Whereby the whole hopes  
 of Experimenting is from the genius of  
 particular Men, to prove and try things  
 as they happen to concerne their thoughts  
 and doubdts of, & they thinck may clear  
 them



## A.z. Authoritys

Them. And It is ffound that the judgm<sup>t</sup> is of More consequence than y<sup>e</sup> Contrivance of the Experiments or y<sup>e</sup> Subtiley of it. S<sup>r</sup> Cartes Could from the Comonest passages judiciously observed & applyed Erect a celestiall Economy. And M<sup>r</sup> Newton by such ordinary things, as y<sup>e</sup> froth of a barber's bason, the shaddow of a Moving Comb /& such like\ strike out an admirable hypothesis of light & colours, whereby it appear's that a Judgm<sup>t</sup> seldome wants Expermt, but as y<sup>e</sup> Sence w<sup>ch</sup> is y<sup>e</sup> Subject of y<sup>e</sup> Judging faculty, hath all its Information from Externall object's, the Nice Consideration of them is y<sup>e</sup> best Experiment, and y<sup>e</sup> tossing them to & ~~from~~ fro, is but for opportunity of making /more\ full & correct observation.<sup>281</sup>

But yet there are subjects ~~that~~ /w<sup>ch</sup> arise out of Imensity &\ doe Not fall under any one man's sence or observation /such\ as winds, tides, y<sup>e</sup> Magnett, &c. A philosofer is at a loss If he hath Not a copious assistance concerning them; So that there is an absolute necessity of an /their\ Naturall history ~~of them~~, and done by the most carefull & judicious observers. wee may as well In a study p<sup>r</sup>tend to chalk out y<sup>e</sup> Governm<sup>ts</sup>, In jupiter as y<sup>e</sup> laws of winds & tides, In this our Earth /without naturall history\. therefore If I doe Not so Exalt /& magnifie\ Experim<sup>t</sup> as some doe yet /ffor the reason given\ I Must Never faile to Exalt /such\ a Naturall History

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<sup>281</sup> This is perhaps the key to RN's 'cartesianism', that natural philosophy is the proper employment of judgment on the matters of the natural world. That is, as is made clear in the next paragraph, reflection on the properly described objects of natural history.

<no number>

Indefinites

<no number>

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Under this title, I propose to Consider, the Nature of body, & Space /& time\ plenitude of y<sup>e</sup> world, or /and\ vacuity; continuity of body, & lastly divisibility of part's. W<sup>ch</sup> I call Indefinites, because they concerne y<sup>e</sup> whole world, & All things In all places, and Not reducible to any certain test of Measure, or Experiment; but are Notions purely of y<sup>e</sup> mind, & to be weighed by reason, and therefore Ever were & will be obnoxious to various fancy's & opinions, to w<sup>ch</sup> I Intend to Subjoyne Mine, and Such little argum<sup>ts</sup>, and reason's as I thinck I have discovered Concerning them, whither from author's or Invention I matter not, while I satisfie my Self, So farr as I p<sup>r</sup>tend.

1. Body and space, have bin made two /different\ subjects, and So neither can be understood. as first ffor body, all agree that body is Extended, and admitts No other body Into y<sup>e</sup> limits of its Substance. w<sup>ch</sup> is called Impenetrability; this is proved by our sence, as a perpetuall property; but No other property can be discovered, as apperteining to body, ffor all other modes of our perceiving body, but that of Impenetrability, may be distroyed, while that remains. But yet, say the modernes, body May have Quality's and property's Incident, tho wee know them Not. as particularly, attraction, by w<sup>ch</sup> Mr. Newton, solves the planetary & terrestriall

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<sup>282</sup> RN explains below (f. 243v) why he adopts the term 'Indefinites' (from Descartes, who was inhibited by 'caption') to deal with the issues of space, matter, continuity and divisibility. This essay is an working out of RN's 'phisickal' ontology.

<sup>283</sup> This page initially numbered 85 (in pencil), that number struck out (in pencil). RN's own page numbering (A, B, etc.) also struck out (in pencil) on the recto side, where shown. The revised BM curatorial numbering contines to the end of the essay on 'Indefinites', at f. 246.

## B. Indefinites.

Economy. but the foundation is p<sup>r</sup>carious. and It cannot be any way proved, ~~but~~ that body hath such a quality as they mean by attraction for all the approaches, and Elongations of bodys ~~may be~~ for ought wee know /may be\ from other Causes. The chimists have a filosofy built on Such principles as salt, sulfur, & mercury; they Sup=~~pose they are~~ /them\ Effective property's, with Congruity's, & aversion's, whereby they would have the active world <space left><sup>284</sup>But these as well as the peripatetick Element<sup>e</sup>, fire water air & earth, are by late Experiments Sufficiently Exploded, being discovered to be Compounds, & discernable, & to Induce various other shapes, ffor w<sup>ch</sup> I Referr to M<sup>r</sup>. Boyls scepticall chimist; So that No Elements of /in\ y<sup>e</sup> world can be certinly p<sup>r</sup>sumed but, longum latum & profundum, but If ought more be, It is unknowne, and So they dispairingly give over.

Then Space, as it is ordinarily discourst of is a chimera more unaccountable, then body. ffor If it be void, What is it? they say Space /y<sup>t</sup> is\. Some=~~thing~~, thay Call space, for Nothing can have no Name; and yet when considered, It is really and truely Nothing; to be something & Nothing is to be, and Not to be; a flat Contradiction, ~~And~~ I-Challeng /w<sup>ch</sup>\ those ~~that~~ /who\ suppose Empty space, have /Not\ Reconciled ~~it~~. D. Cartes hath a most Noble thought concerning ~~these Elements~~ /the subject\, and it is that body and Space are one, and the same.

ffor

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<sup>284</sup> Space (or the body of a space) left, with dashes.

for /according to him\ Space, If any thing, is /must be\ Extension, and bo=  
 dy is No other; Since /for\ nothing /Els of\ ~~Incident to~~ body's  
 besides Extension, can be discovered, he avows /can be argued as In-se its Extension; other  
 fantasmies\  
~~probable that Extension, and body are all one,~~ /by w<sup>ch</sup> wee discover it, as Colour ~~that is~~  
 Space, sound, &c. are all\  
 and the philosefers /deprivable therefore says he\ vacuum is a contradic=  
 tion, as to Say Extension without Extension.  
 This most admirable discovery, as I must Call /of his w<sup>ch</sup> Nothing\  
 it of his, tho justly to be accounted the fruit /less then utmost effort of humane capacity  
 in thinking\  
 of the ulti~~mate~~ power of humane thought, /could have produced  
 hath Not had y<sup>e</sup> luck to be/in\ Much countenanc~~t~~  
 among the vertuosi, & Many /especially of a latter faction\ deny the Major  
 /y<sup>e</sup> argument\ and affirme vacuity. for, say they, Extension and  
 Impenetrable are two things. for Space in w<sup>ch</sup>  
 No body resides, may admitt body /but one body cannot admitt another\ ~~to Enter,~~ &  
 therefore Extension doth Not /necessarily\ Include Impene=  
 trable/ity\. I know according to the /present\ State of the Con=  
 troversie at p<sup>re</sup>sent, this subterfuge /hath Not bin removed\ is Not Eluded,  
 but y<sup>e</sup> Objection to Cartesius thought Stands, &  
 y<sup>e</sup> p<sup>re</sup>sent /there is a\ disposition is to Establish /rather to Entertein a\ vacuum.

It seem's to Me, that Cartesius May be de=  
 fended in this; tho I must admitt /Cartesius hath delivered\ his Notion  
 to be /somewhat\ dogmatically and /the it\ Not eapable /so well reaso\ned /by him\ as  
 it is Capable /might be tho I must needs say, the very hint is sufficient\ the cours I take  
 with it is this  
 /to\ Make but one Question of these, Instead /of two\  
 that is Consider /onely\ Space or Extension In /by\ itself  
 and See whither the result may produce be= /laying aside all Consideration of body as If None  
 were in y<sup>e</sup> world\  
 dy's, and then all Question & dispute of that & /And then if if In Space, wee find all that  
 wee know or need In\  
 the /supposed\ property's, vanisheth /y<sup>e</sup> notion of body, the scrutiny of that is saved\ ffor  
 it is foolish to

## D. Indefinites

Make two Inquiry's when one cleared the other  
 is dissolved. /but /on y<sup>e</sup> Contrary in there<sup>285</sup> it is usuall first to determine of body & then  
 of space w<sup>ch</sup> I thinck a wrong cours\ Then that Space is Extended as well  
 as body, is admitted, that property is Comon  
 to both then as ~~to~~ /I affirme\ Impenetrability ~~it seem's~~  
 necessarily /Incident\ ~~to~~ /belong\ ~~obtein~~ to Space. ffor ~~to put~~ /can\ two  
 Spaces /be put\ into one /?\ space; ~~as two equall~~ /ones\ Spaces  
~~together & those~~ /that\ into a third & so on; /In\ is litle  
~~less then Nonsense to Inquire.~~ /as must be if space be penetrable?\ ffor ~~that wee~~  
 Call /space as\ Extension, /is determinate\ ~~is the Same thing, as is~~ /is what wee\ con=  
~~ceived when space is mentioned and how~~  
 /as is done if divers are crowd into one, for all together are but that\ then can that be  
 Contracted? is it possible  
 to make Space or Extension /to be\ less /of\ space in  
 Extension then it is; If Not, as must be ans<sup>d</sup>,  
 the two spaces cannot be put together  
 into one /that is space or extension is Impenetrable, for\. If Space be any thing, and /be\  
 penetra=  
 ble it is plaine, Space it's like ~~(if any thing)~~ /that is the same\  
 /as the other\ may be put into it. ~~and then~~ /so that\ 2. cubick feet  
 of Extension are become one, & ~~that may Still~~ /with as litle trouble\  
~~contract, and become~~ No Space at all. there=  
 fore space or that thing (wee know Not What)  
 Extended, /Such as our Idea of space is\ cannot admitt y<sup>e</sup> like into its limits  
~~and so on both sides the Extension's become~~  
~~less by, [analition?] then before, w<sup>ch</sup> is Impossible,~~  
 for thing's are, & will be as they are, without  
 Some efficient to make or unmake them.  
 Whereby Extension while Such, will keeps its  
 Extension, that is be Impenetrable, w<sup>ch</sup> is all  
 that can be affirmed of body. Then /as I sayd\ wee are  
 Eased of the Inquiry of the body and its pro=  
 perty's (or Intrinsick Nature,) ffor it is No other  
 then space

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<sup>285</sup> There are superscriptions and insertions added as corrections to additions, it is not clear what is added to what at this point.

then Space or Extension and /the\ Impenetrability  
 is /by w<sup>ch</sup> wee [perce to?] & know it is but\ a consequence, ~~ffor extension will Not Ceas~~  
~~to be, as it must i/o\ f its Essence failes, & it becomes~~  
~~not Extended or less~~ /w<sup>ch</sup> cannot become less extended\ then it was by penetration.  
~~And by this~~ /by this also\ wee are delivered of the senceless  
 Incoherence, of the Notion of space Empty of  
 body, w<sup>ch</sup> if it be, ~~must be~~ /att all must as I sayd be\ something & yet  
~~Inquired into is found to be~~ Nothing. /All w<sup>ch</sup>\ ~~And this~~  
 wonderfully magnifies the ~~simplicity~~ /Glory\ of the  
 of the creation, w<sup>ch</sup> ~~with all the beauty's and~~ /that Such Infinite order & variety of\  
 variety's /as are & variety\ In ye univers, ~~is accomplisht in one~~ /should be produced by one  
 Single\  
~~Single fiat, Extension wee litle Reflect what~~ /created thing Space.\  
 a /It was an Invention\ devine ~~Invention that was~~ /with a [witness?]\, and how Mi=  
 raculously appropriate to ye Service and feli=  
 city of sensible being's, ~~that~~ /w<sup>ch</sup>\ subsist In so  
 prodigious a capacity /so prodigiously\ connected with it  
~~whereby beauty's &~~ /out of w<sup>ch</sup> Union flows\ excellency's /In ye way of Sensation and\ ~~are~~  
~~perceiv~~  
 /Reasoning\ w<sup>ch</sup> ~~are~~ /w<sup>ch</sup> Could\ Not /be\ Extant In Either alone. ffor  
 what a plain /sterile\ buissness is body onely broken  
 & Moved /take it where you will\ and nothing ~~Els reall in body is~~ /more is extant really\  
~~discovered~~ in ye /naturall\ World; and /on ye other side\ what hath Exten=  
 sion or body to doe with, or how can it affect  
 being's /whose essence is Not at all Space\ ~~Not Extended?~~ /of one sort combined with ye other\  
 yet these Joynd pro=  
 duce /all\ the ~~objects~~ /modes & variety\ of Sence, that is Images /or Ideas\ made  
~~by the composition of both,~~ w<sup>ch</sup> Neither alone  
 can /could Injoy or\ claime. I shall consider this Exaltd Sub=  
 ject Elsewhere, & guess how, minds may /[united?] to &\ have  
 power Of Moving body; at p<sup>r</sup>sent I can onely  
 Say, that who Ever Reflect's on these thing's, &  
 /hath\ ~~is Not~~ /Not\ religionus, is a right downe Stupid fool.



## F. Indefinites.

But Now to prosecute the discours toucht upon concerning vacuity. I take y<sup>e</sup> notion of it to be but a chimera bredd out of p<sup>r</sup>judice, and is occasioned by the manner of our perceiving thing's being ~~most in such~~ for, ~~that~~ while some body's are /& others are Not apparent to us, and all Intermix\ ~~very sensible others are Not~~ /in\ ~~sensible at all tho the~~ /within and yet notorious\ limits /as for Instance vessells\ that Compre=  
hend all are perceived. /y<sup>e</sup> Contents whereof are together in Some visible & in others not, (tho equally full)\ then says Sence, there appears to Me a Space without body /these are full and these Empty within these limits\ and then translates /so the Imagination, translating\ that Image /from Sence , distinguishing full & empty\ to Nature, and Concludes that /is the occasion that Men conclude\ space may be /subsist\ without any thing In it. /ffor say they /w<sup>ch</sup>\ cannot Imagin but it must be so I grant y<sup>e</sup> Imagination\<sup>286</sup> But there is No force In that way of Concluding /Arguing ffor\; but rather /y<sup>e</sup> consequence of experim<sup>t</sup>\ the contrary /[...?] is more justly Inferred /then a consequence /[[vacuous creation?]\ of Imagination\. ffor It follow's Not that be=  
caus vessells seem Empty to us there may be Empty ness in Nature /becaus some vessells seem to us to be Empty so\ but rather, Since what seem's to us Empty /so Empty\, is allwais upon proof found to be full, wee ought to Conclude /that\ No place is Empty /becaus wee cannot discover or prove any is so\. It is as Strong an argum<sup>t</sup> as the /as Strong as\ univer=  
sality and Constancy of Experience Can induce. w<sup>ch</sup> tho Not demonstration yet hath weight at least Enough to ~~out way~~ /bear downe y<sup>e</sup> other Inference of the\ the other and ~~contrary, I must allow~~ /of vacuity w<sup>ch</sup> hath no foundation but in fancy\ it is /certainly\ a fallacious way of arguing, from sence, to thing's; And More fals philosophy is owing to it, then to all other Elenchy.<sup>287</sup> It was thence men Enterteined Intentionall Species flying from y<sup>e</sup> objects to our Ey's; that colours Subsist in y<sup>e</sup> dark, & such like, w<sup>ch</sup> modern Sapience hath overcome, but yet  
that

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<sup>286</sup> This superscript stands more as a marginal comment than as part of the continuous discourse.

<sup>287</sup> i.e., 'refutation of an argument', philosophical term from Greek, via Latin

That Sence bred p<sup>r</sup>judice, on w<sup>ch</sup> vacuum  
 is entertained, ~~holds~~ is not yet confounded.  
 but remains one of the instances of the migh=  
 ty power of p<sup>r</sup>judice /fancy\ w<sup>ch</sup> will Uphold the ex=  
 istence of thing's from meer may be's & simi=  
 larity's, ~~tho of things appearing~~ /tho the occasion deludes as when things seem to us\ empty,  
 while  
 /w<sup>ch</sup>\ wee know ~~really they are~~ /to be in truth\ full. Lawyers ~~call use~~  
 Say a very disputable point, is casus pro amico,<sup>288</sup>  
 so In philosophy. If there be not manifest demonstra=  
 tion, authority carry's it. And If one age, or person  
 holds y<sup>e</sup> one side, y<sup>e</sup> Next, to seem wiser, will  
 assuredly hold y<sup>e</sup> other. As Aristotle /purposely\ ~~to~~ cross/ing\ the  
 ancient naturalist's, built a fame upon y<sup>e</sup>  
 caprice of his braine. Therefore however vaine  
 I think the conceipt of vacuity, I am Satis=  
 fied it is Impossible to ffix y<sup>e</sup> subject, but it  
 Shall flitt to & fro as Great witt's in philosophy  
 happen from opinion or from out of Contra=  
 diction, to lead y<sup>e</sup> world; tho y<sup>e</sup> faction for va=  
 cuity Shall ever have y<sup>e</sup> advantage becaus  
 they have y<sup>e</sup> vulgar with them, and If any  
 happen, as Cartesius, with /from\ extream depth of  
 thought, shall to ~~add another~~ /to bring forth other\ & More cogent  
 argument's ag<sup>t</sup> it; the Next great artist  
 that Countenances y<sup>e</sup> opposit opinion, setts  
 all in Relaps againe; so prone is Mankind  
 to give way to any prepossession In their Minds

---

<sup>288</sup> 'find for a friend', i.e., bias; that we agree with the argument with which we are familiar, or which is supported by our side (an implicit criticism of party, as develops lower on the page and elsewhere, ubiquitously, in RN's MSS).

H. Indefinites.

whereby philosophy w<sup>ch</sup> by Heroick labouring  
~~minds~~ Spirits is brought towards a state of  
 Rectitude, is no sooner lett loos, ~~to the~~ but  
 the depraved world crook's it againe to Make  
 it conformable to their Errors & fond Mistakes.

Hee that hath closed this point of vacuity  
 agitated among the vertuosi since Cartesius  
 is the author of the principia. &c. Whose Ma=  
 thematick process is so Excellent & Exact that  
 it hath almost fixt in y<sup>e</sup> word the most /p<sup>r</sup>carious?] &\ depra=  
 ved hypothesis /of phisicks\, ~~next~~ Aristotles /always excepted\, y<sup>t</sup> Ever was In=  
 vented. He is carefull in termes to decline  
 Engaging in any hypothesis, but really one  
 y<sup>t</sup> run's may read his Mind, tho Not clearly  
 Explained; As that y<sup>e</sup> univers is an Infinite  
 vacuum, bating here and there a sun and  
 a few planetts attending dispers't about.  
 and those with their atmosphears are lumps  
 of body, w<sup>ch</sup> operate on Each other attrac=  
 tively, w<sup>ch</sup> ~~with~~ /so that ~~and together~~ [cross?] attractions &\ certein centripetall and  
 centri=  
 fugal forces, that body is possessed of, /[-+?] ballancing each other\ keeps  
 all /the world\ In that Cours & order ~~they are in~~ /wee know it by\; and Suppo=  
 sing these true, (if he thought Not so, Why  
 should it be Supposed,) he proceeds more geo=  
 metrico, to demonstrate y<sup>e</sup> Cours of y<sup>e</sup> planets &c  
 I shall but note one observation of this author  
 in generall that, altho his best things are  
 taken

taken from Cartesius, as y<sup>e</sup> Worlds Extension  
 and y<sup>e</sup> laws of Motion, besides the Method  
 of proceeding with mathematick exactnes,  
 yet it is apparent that his whole aim &  
 designe In w<sup>ch</sup> he hath laboured so hard is  
 to overturne cartesius philosophy, And the coro=  
 lary's come out No where so triumphant  
 as when they diametrically thwart some  
 some cardinall /~~earte~~\ opinion /theoreme\ of y<sup>e</sup> cartesian /Hypothesis\ and  
 of this, Call /take but\ ~~one thing speak, He sets~~ /Instance and that's the setting\ up  
 Quality's  
as attraction, &c. In overturning w<sup>ch</sup>, Cartesius did  
y<sup>e</sup> world so /very\ much service, If knowledg be /of\ any /value\,  
and Ignorance, of w<sup>ch</sup> Quality's were allwais a  
Grand asylum, No Inconvenience /shame In overturning them.\

But as to vacuum I have a few things to ob=  
 serve, ffirst that there is No need of it, to acco=  
 modate any occasion Nature hath, ~~for it and~~  
~~particuallly motion, w<sup>ch</sup>~~ /motion Inconsistent with plenitude\ some have held it  
 impossible, /and\ with/out\ Interspers't vacuity's, /Impossible on y<sup>e</sup> [...?]\ as it  
 is observed to be in various figured matter.  
 I shall Reserve this /matter\ till I speak of Infinite  
 divisibility. but In y<sup>e</sup> mean time it May be  
 noted that granting /the\ possibility of vacuum  
 motion would No less want it among us. ffor  
 the Grand Recess of the mundane Matter  
 from

## K. Indefinites

from y<sup>e</sup> Sun y<sup>e</sup> center of its Motion, or more  
 Immediately from y<sup>e</sup> Earth's center, or to it  
 w<sup>ch</sup> you pleas, would crowd y<sup>e</sup> Inferior Matter so  
 close, as small part's would not have ~~force~~ /power\ with  
 their languid force of turning to ~~Move it~~. /Remove y<sup>e</sup> burden\ so /y<sup>t</sup>\  
 vacuity is No Expedient of Motion. And Surely  
 there is No reason without /a why or a wherefore or Indeed\ absolute Necessity  
 to Introduce a vacuum.

I have Not met with any stranger flight of  
 opinion the M<sup>r</sup> Newton's /Insinuated\ hypothesis ~~of the~~  
~~world~~ Containes, ffor he supposeth that the  
 force of attraction, centrifugall & centripe=  
 tall vertues, Especially y<sup>e</sup> first works thro the  
 Imens vacuity's of y<sup>e</sup> world. Now I would ask  
 what Conn~~ext~~/ekts\ body's ~~when~~ /between w<sup>ch</sup>\ Nothing /is\ ~~'s between~~;  
 and If the Space be Empty /Sure\ it is empty /Every thing and so\ of all  
 attractive powers /for those are Somewhat\. the Monstrosity of these In=  
 sinuation's, and ~~by~~ /from\ one of such ~~Excellent~~  
 accuracy of thought & expression argues that  
 his opinions are ~~more~~ /not at bottom so un-\reasonable /as they seem\ but he Con=  
 ceals ~~them~~ /the maine\, & throw's out these Enigma's for  
 men to whett their witt's upon; and It is Not  
 Improbable, or at least wee may hope, when  
 so kind to y<sup>e</sup> world, & just to himself /In\ ~~as he May~~  
~~possibly by publishing a Compleat body of phisicks~~ /his owne phisicall hypothesis\

The sume of all this is that body and Space  
 are the same, /It is in\ the ~~result~~ /essence\ of space to keep /its\  
 Essence, that is ~~Impenetrabilty the consequence~~ /Extension, and so becaus\  
 of that is ~~Impetra/ble whereby~~ and it is from Impe=~~bility, by w<sup>ch</sup> wee come to~~  
 /netrability that wee\ know this creature space, & name /call\ it body, but  
 then wee ~~Introduce a chimera of~~ /give way to a\ Meer fancy,  
 the Idea of Emptyness, ~~from~~ /occasioned by\ Non perception of  
 the ~~Same thing wee call~~ body, and ~~this wee~~ Call  
 /as if because wee some ~~of we~~ times perceiv none its possible there then be None<sup>289</sup> /it\  
 Space; and So Make a troublesome distinction  
 /from synonymy\ of body & Space, w<sup>ch</sup> /when yeilded to hath Ever done & ever\ will afford  
 Eternall per=  
 /Irreconcileable\ plexity & doubdt & ~~Never be Reconsiled.~~

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<sup>289</sup> As above, this superscript stands more as a marginal comment than as part of the continuous discourse.

## N. Indefinites

## Continuity

Among the property's /of our\ & modes Incident ~~to~~ /whereby we\  
~~our~~ perception/ive\ of body, wee may /[-+?]\ account  
flexure, Continuity, devisibility, & Motion. /as ye cheif\  
/ffirst I observe that In simple Elementary part of matter (of any sort be)\ The settled  
property of being Impenetrable Ex=  
cludes all flexure; ffor when a Strait thing is  
bowed, the outward convex side is Extended, &  
the Inward Concave is contracted; w<sup>ch</sup> without  
the part's chang place, and some goe more  
asunder, & ye other pack closer together, Can=  
not be, ~~but by supposall~~ of /be without\ penetration, of  
w<sup>ch</sup> Enough hath bin sayd. But /the caus Efficient of\ Continuity of  
part's, or by what vertue it mean's, separate  
body's (such as for Smallness are called parts)  
stick together so as not to devide with out active  
force, is /such\ a Mistery In phisiology, as ye world hath  
not Ever /yet\ thought well Resolved. ffor the ans<sup>r</sup>  
Ever fly's from us, & ye Question Returnes. as how=  
~~Ever~~ you /[Suppising?]\ bodys\ analized ~~body's~~, & Reduced ~~them~~ to  
Elementary parts ~~to~~ solve /all that can be alledged found.\ their cohesion  
~~that was asked of the aggregate,~~ is /must be sought for, to Resolve how ye sub-parts, or the  
spaces\ as proper  
~~to be asked of such part~~ /of those parts where\. as /for Instance\ Say they, Stick toge=  
ther by hook's & Irregularity's, how /What\ then was /is it\  
~~the part that make those Hooks cohere?~~ /that holds ye Subparts together\  
et

Et sic in Infinitum;<sup>290</sup> but then /suppose\ with the atomists  
~~say~~ that the Elementary part's are adaman  
 tine, & Indiscernable; then body's once Com=  
 pound by clasping together, could by No force  
 be crush't or broken. w<sup>ch</sup> is Contrary to Experi=  
 Ence. So take what way wee will, wee slipp,  
 & hold No Ground.

Cartesius among ~~ether~~ his other /generall Notions In\ thoughts  
 concerning the generalls of Naturall Science /his ffor w<sup>ch</sup> he justly is & Ever will be  
 celebrated\  
 hath one concerning Continuity, W<sup>ch</sup> I thinck  
 Easeth the throws & pangs of this Question; it  
 Is that /things are held together\ Meer Contact ~~holds things together,~~ /in a state of Rest\  
 and his Expression is, that No Glew is stronger  
 then rest /is\, to hold divers body's /resting together\ In continu=  
 all Contact. this is also by him /delivered Somewhat\ dogmatically  
 delivered, and I thinck might be More /that is Not\ reason=  
 ed then he hath done. And this want /so much as might have bin, w<sup>ch</sup> defect\, If it be  
 any, hath made y<sup>e</sup> world Reject the solution  
 as Gratis dictum;<sup>291</sup> ffor granting that y<sup>e</sup> Witt of  
 man cannot find /any thing Els but Contact & rest ~~can be Imagined to\ ought~~ among body's that  
 cohere /them\, ~~but contacts; It~~ /yet say they\ neither follow's, Nor  
 can they Conceiv how it /resting contact\ Should be s<sup>e</sup> /like Glew\, and  
 hereupon /this point\ our academicks /use that p<sup>r</sup>ogative &\, Insult Most  
 magesterially, /admiring\ that such a p<sup>r</sup>tending /[[primpour?]\phi=  
 losofer /as Cartes\ Should advance such a /a princple so\ p<sup>r</sup>carious prin=  
 eiple to Solve /for solving\ one of the cheif phaneomena of Nature  
 <flourish underline>

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<sup>290</sup> i.e., 'and so forth to infinity'

<sup>291</sup> i.e., 'something said without proof (and without any responsibilty for its being true)'



O Indefinites.

I am so singular, to admire this thought Equall  
 with any of his, and thinck he is to be defended  
 in it. ffor I would ask their tutorships, what it is  
 they mean, when speaking of body, they say  
 [..?]<sup>292</sup> one and the same? it Can be onely that the  
 parts Rest in perpetuall Contact. as for Instance  
 let an Elementary or unporous part be proposed,  
 It hath part's, whatever y<sup>e</sup> Magnitude, & the  
 least hath as many halves and Quarters as the  
 Greatest. What difference is there between /one\ half con=  
 sidered ~~fr~~ as Joyned with y<sup>e</sup> Other half, before a  
 separation and after being Rejoyned as aptly  
 touching /as\ before? ffor If the same points touch  
 sure ~~the case is y<sup>e</sup> same~~ /it [is ..?]\ In Every Respect /all one\ Whither  
 y<sup>e</sup> part was so created, or being Severall put  
 together. therefore wee must take it for Granted  
 that whither /Rest in\ contact hath any Effect like that  
 wee call cohesion or Not; there is No other Means  
 of cohesion In Nature. And If part's continue uni=  
 ted being once made so, that is resting in Contact  
 the like happening by any means, the union Will  
 In y<sup>e</sup> Same manner Continue. and the being ac=  
 counted one and y<sup>e</sup> same is due to y<sup>e</sup> latter case  
 as well as y<sup>e</sup> other. the rather because, If wee Suppose  
 2 cubick part's with 2 sides adapted together  
 & touching in all points ~~as y<sup>e</sup> Rest of y<sup>e</sup>~~ /exquisitely as all the other\ parts of  
 the cubes touch. there is of them two Made one  
 paralellipedon; And there is No argument  
 why ~~this tr~~ that one Should devide In y<sup>e</sup> place  
 of y<sup>e</sup> juncture then In any other place of it.

---

<sup>292</sup> This *might* be an inverted question mark ...

Therefore I conclude that If body's touch Exquisitely, they are united in y<sup>e</sup> juncture, and hold together as Much by Contact, as the other part's do by y<sup>e</sup> like. But Now 2. Inquirys Re-  
maine, 1. Why any Contact Should unite? 2. with what force.?

1. I am In doubt whither I may Not Say that coalition is a property of body, as Impenetrability. ffor Consider body under the notion of Space, and then that 2 spaces Meet, there is a coalition, so that there Remains No juncture but all places in y<sup>e</sup> limits are alike. the Same holds of body, ~~when~~ w<sup>ch</sup> I affirme is No other then Space. ffor If two body's touch, what is that but a Coalition; And then whatever is the Strength of body ag<sup>t</sup> crushing, ~~or~~ to Retein its figura, or prevent fracture, is that w<sup>ch</sup> holds the part's together, and so also two body's In Resting Contact.

2. The strength or Nerve of body Resisting separation, or Crushing, is the Same as afterwards will be Shewed In discoursing of the laws of Motion; that is, Quantity, opposed by Quantity. ffor as all body's Influence, or are Influenced by Motion, according to the proportion of the Quantity's, so here. take the Quantity passive, & that active (If I may here so speak) & compare them  
and

## Q. Indefinites

And ye Greater shall p<sup>r</sup>vaile over the less. as If  
 a part be plac't in an Engin so as a Moiety of  
 it is prominent, and a Greater force fall's upon  
 it, the lesser must give way. The Rest of body's  
 Require /hath\ as much ~~caus~~ /of active force\ to continue, as mottion  
 of other to persevere. therefore I hold Not that  
 Elementary part's are Inseparable but they Re=  
 quire a certain force to devide them, as Every body  
 resting, requires a force to Move it. But the parts  
 of matter, such as I mentioned, cannot be so En=  
 gaged but ~~bring what force you will upon them~~  
~~they~~ move away /from ye force\ and unless falling between gre=  
 ter forces meeting cannot Crush. And hence it is  
 that Cohesion appears to us. ffor It is Manifest  
 If a body be ~~put in~~ free No /A\ stroke ~~whatever~~ /doth Not ope=\  
 ean /rate to\ devided it, unless It be drawne out in length  
 or hath prominences on w<sup>ch</sup> ye force comes ~~sudden~~  
 ly. As a Globe or cube /without pore\ No stroke can break,  
 but If a point was thrust out in length from Ei=  
 ther, that may break of. becaus ye force dri=  
 ves one way, and /Greatest substance of ye\ ye body holds back. but Els bo=  
 dy's whose part's are perpetually contiguous, Re=  
 ceiv ye force & are Influenc't by ye Stroke, as that  
 is on w<sup>ch</sup> it falls and the stroke doth Not tend /allwais\  
 to Make a separation. ~~but~~ /but Most often to drive on\ this that I say of ele=  
 mentary or unporous matter, cannot be so Intirely  
 applied to compound body's of w<sup>ch</sup> ye texture, and  
 Spissitude is So various, as may make great diffe  
 -rence

-rence. W<sup>ch</sup> I will Consider In severall Instances, w<sup>ch</sup> may concerne one sort, & y<sup>e</sup> other.

1. It is admitted No contact passing Makes any cohesion, as two body's meeting part againe, by y<sup>e</sup> energy of y<sup>e</sup> Stroke. And it is by Meer accident that body Can happen to Rest In posture Con= tiguous, ffor fluids, w<sup>ch</sup> Makes Infinitely y<sup>e</sup> Gre= test part of y<sup>e</sup> univers, are In perpetuall In= testine Motion, So it is No wonder that cohesi= on takes place, Among body's Not fluid, that is not susceptible of that kind of Motion as fluids have. But Even such, when accident Retards their moving, then cohesion begin's, as wee See in freezing & cooling, In water, wax, &c.

2. If body's touch by points, such can breed No cohesion, ffor the least force, gets y<sup>e</sup> better, but to occasion a cohesion, the Contact must be by a superficies, and then there is Substance, accor= ding to w<sup>ch</sup>, the strength of it is. Wee see that body Cohesible may coalesce with fluids /and Not fix them\ as Salt In water, ffor tho y<sup>e</sup> Salt, May, as is Supposed, consist of plane-sided sided Shapes, y<sup>e</sup> water may be /of\ curve-sided formes, w<sup>ch</sup> touch y<sup>e</sup> planes but by points, but when In setling or Cooling, the plane= sided come to face together, they fix againe, & Shoot onto Such formes, as their [Shapes?] are apt to take.

## S. Indefinites

3. Then Supposing, as there is reason, that generally the /terrene\ compound body's are made up of various & Irregular Elem<sup>ts</sup>, such as accidentall occurs bring's together; [as?] curve sided, plane, ragged, Either /more or less\ aptly or Inept for Conjunction, where by Some fall closer compact, & touch by fewer points & more sides then other's; It is No wonder that wee have Such variety & degrees of tenacity In Compounds. It is reasonable to Suppose such variety's In y<sup>e</sup> Elements, should produce corresponding variation's of Compounds, but It is Impossible to ans<sup>r</sup> as to particular cases, becaus proofs of minute formes Cannot be Made, No Experiment plainley reaching them. So that If paralellipedons meet they may compose diamonds, ruby's, &c. and semi-globular Stuff, may make butter, or wax; or other formes as well, If there be like reason, by more or less compaction & flatt junctures, or punctuated junctures, yet there is more reason to Make Conjectures of Some Compounds then of others, as for Instance Salts, w<sup>ch</sup> Ever shoot in planesided figures,<sup>293</sup> w<sup>ch</sup> argues them to be Composed of planesided parts. but What Makes Coagulates, mettalls, &c. wee know not yet, tho of the latter wee can discerne, much alteration Made in y<sup>e</sup> texture by fire In breaking or shattering y<sup>e</sup> texture, as wee See in tempering, & nealing, w<sup>ch</sup> tradesmen know well.<sup>294</sup>

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<sup>293</sup> RN is here able to refer to the experimental evidence provided by crystal growing, and microscopic analysis.

<sup>294</sup> Here, as in other places, RN makes affirmative reference to artisanal knowledge, reminiscent of the positive evaluation of practical knowledge in the world characteristic not only of Descartes, but also the Baconian tradition continued from Bacon, via Samuel Hartlib, to the Royal Society in its first two decades. Elsewhere we find also approving reference to the knowledge and wisdom of nursing women (as for instance in 'of Humane Capacity', Add MS 32526, f. 37r), and peasants (in this volume, 'on Science', f. 192r).

4. Then as to the strength of Cohesion of part's wee make o<sup>r</sup> selves wonder by making rash Estimates of force, ~~w<sup>ch</sup> wee Ever regulate by o<sup>r</sup> Owne.~~ wee wonder a wire of mettall by y<sup>e</sup> length Should suspend. 5<sup>th</sup>. weight; I ask what is 5<sup>th</sup>. weight, the weakness of that may be wondered at as well as y<sup>e</sup> Strength of y<sup>e</sup> other. but wee find y<sup>e</sup> Weight by o<sup>r</sup> Selves great; I ask what is our strength /that may be weak too\? But /then\ wee /may\ say, weight putts on greater body /such as y<sup>e</sup> 5<sup>th</sup>, weight\ in a Motion so Swift /as y<sup>e</sup> descent is with\ and that is more then y<sup>e</sup> Substance of the wire can by its bulk resist.. This I must owne, doth argue somewhat positive In the cohesion of materiall part's; w<sup>ch</sup> may be So, for ought wee can ~~Contravert~~ /positively declare to y<sup>e</sup> contrary\ but whatever it is, ~~its is~~ /no less\ Effectuall upon the place of Resting contact, as /or [junction?] then\ it is In all o<sup>r</sup> ther places of body, for there is No distinction by place, ~~when~~ all touch /being\ alike. And it is No less certain that it is with More, or less Strength as body are Greater or Smaller, or as the contact is on more or less, of superficies. ffor whatever y<sup>e</sup> Caus of the Cohesion is it is more or less effectuall according to the Measure of y<sup>e</sup> Quantity. therefore If a stated force will break a body of an Inch Girt, there must be a greater In duplicate proportion to break one of 2, Inch Girt.<sup>295</sup>

5. But Now to weight this point of a cohesive quality In body (If I may use the terme,) upon o<sup>r</sup> hypothesis, and see if it be absolutely Necessary.

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<sup>295</sup> i.e., 'girth, thickness'

## V. Indefinites.

It was proposed that body, & space are all one, and space as Such must be Impenetrable, and therefore body. Now ye consequence of this, that one space must give way to another, Especially if Greater, produceth the phenomena of Motion, as will largely be Shewed. but What can hold a Space or body so as to make on part Come away from another? as let A.B.C.D. be a body without <diagram> pore. and A. & B. work to force, ye part E.A. towards A. and ye other part E.B. towards B. where shall this Break; In the least part as for Instance c.D. but lett all part's be of Equall Girt. No Mortall can say, whither it Shall break at all, without also determining where. But to clear the point fully, the plenitude of the world is a positive Im=pedim<sup>t</sup> from its breaking at all /In ye manner proposed\. ffor unless there be Matter to Enter ye fracture, (w<sup>ch</sup> here wee Will suppose to open paralell) so As to be at E. as soon as it is at c. or D. the body cannot part in that Manner. And If ye matter at c. & D. were (as hereafter wee May Suppose) Infinitely Small, yet it cannot be at E. as soon as at D. becaus all motion /must be\ in time successive, & E. D. here is that w<sup>ch</sup>, from ye nature of Space /with-a\ or body, and the ple= nitude of the world /without other principle\ Shews that it is Not descer= pable In Every manner, w<sup>ch</sup> in Some measure answer's the cohesion of part's, ffor In compounds  
however

However wee deal with y<sup>e</sup> out-side, wee cannot come at the Inward part's, on a Sudden; Nor is it possible to make a fracture in paralellisme; but by dislocation of parts; and Angular opening. The pyrotechnic shews us, that No Compound, is proof ag<sup>t</sup> fire, w<sup>ch</sup> work's on y<sup>e</sup> Minute parts, and ~~perhaps~~ by y<sup>e</sup> pores, works upon the Inmost Recesses as well as the outsides; untill It Infallibly breaks it In peices; therefore wee must Conclude a Mechanick aplication will ~~open~~ devide any body, but Every force will Not doe it. So that our fingers w<sup>ch</sup> to y<sup>e</sup> Minutes of body are /as\ Gigantick or M Immens, cannot discep or crumble /all\ compounds knotted together by Contact. such as stones. mettalls. &c. but Most Especially all y<sup>e</sup> funicular kind. And to conclude this paragraff, to ans<sup>r</sup> the phenomenon of cohesion, It is Enough to Shew /(as I have done)\ that body's, some way's, are Indiscerpable, and then till wee use y<sup>e</sup> proper way's, such as pyroteckny affords, cohesion Must Continue.

6. That this fancy of cohesion being Caused by y<sup>e</sup> plenitude of y<sup>e</sup> World, is Not a meer brainworme, I shall add a demonstration by Experiment of the like Energy, tho Not In y<sup>e</sup> Same Subject. And that is the cohesion of /flat polite\ Marbles If drawne from Each other parallelwise. as. If <diagram> A. C. touch B. D., If A c. be drawne towards E. & B. D. towards. F. they Shall Not part without an Immens force.



The reason is, the Air w<sup>ch</sup> is to fall Into y<sup>e</sup> Space between made by their opening, cannot be in y<sup>e</sup> middle so soon as at y<sup>e</sup> Edges; therefore all y<sup>e</sup> hindrance that the want of air Can make is Effective, & makes the opening of them difficult but sliding, or opening angularly hath None of that Impediment, becaus sliding No air need Enter, and such opening admitts air In all the moments & degrees of it. It is well knowne and proved by Experi<sup>t</sup>, that this Impedim<sup>t</sup>, or cohesion, that makes y<sup>e</sup> Marbles Not part flattwise, is No stronger the y<sup>e</sup> Weight of the Atmospheare; ffor y<sup>e</sup> Marbles are permeable by minuter Matter, as an hedg or ~~haystack~~ /corne sheaf\ is to /comon\ air, therefore upon y<sup>e</sup> flat parting, tho y<sup>e</sup> air come not in to fill all at once, yet the Minute matter doth, and /butt\ y<sup>e</sup> want of air Makes that Space a torricelian vaccuity, ~~that~~ /w<sup>ch</sup>\ gives y<sup>e</sup> at=  
mosphear power of working with all its force to keep the marbles together; and any force too hard for that will part them. But If wee Suppose y<sup>e</sup> Marbles to be unporous, so as No Minute Matter could permeate them, to Enter y<sup>e</sup> Space, I say No force in y<sup>e</sup> world Could part those Marbles, ffor supposing the plenitude In y<sup>e</sup> world, as wee doe, that make Space & body y<sup>e</sup> Same. there is Not room for it, without penetration. And this I take to be the case of those body's, on w<sup>ch</sup> the principle of cohesion depends, I mean y<sup>e</sup> Minute Matter of y<sup>e</sup> world

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<sup>296</sup> RN numbers this page 'W', repeating the numbering of the previous page. He doesn't often do this, but it is the kind of mistake he often makes.

<diagram> Now to Apply this to the case of compounds; If we suppose a solid Compound In this manner, It is very hard If Not Impossible to break it. ffor all ye openings will Not be as one angle. ffor to break it, multitudes of flatt superficies Must be made, that cannot in very moment admitt matter to fill them, & then they cannot break; It is true part's on ye out side may be brush't off, wch by ye action of fire may have a Quicker dispatch. but a generall Separation of one part from another almost by /with\ any force, cannot /scarc?\ be.

7. But If we Consider Compounds as a peice of steel, for Instance, and Could Magnifie it, So as to Make it as bigg as a Mountaine, what various asperity's, composition's, hollows, meander's would appear. as also of Diamonds, Salts, wood & ye like? So that our supposition would fall in yet greater minuteness then could Even there be discovered, and ye body would appear an aggregate of compounds. Wee are Not therefore to be In admiration that there are such variety of Compounds, & different orders of cohesion as to their tenacity, Some Exp to us, Extream /hard\ as diamonds other Soft as wax & comon coagulates; ffor it may all well proceed from the /their various\ textures; but having once a principle of cohesion, Incident to Body, as before defined, In what minuteness so Ever it resides, the solution holds

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Y. Indefinites.

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## Divisibility.

I lay /it\ downe for an universall Rule of Body & ~~weh~~ is without Exception, that Every thing May be affirmed of it, as can be Imagined Consistent with its Essence space /&\ ~~with the Inferred~~ /with\ Impenetrability: /so\ as ~~to be~~ /it may subsist\ In any part's, shapes and postures ~~to~~ rest or move with all velocitys & directions, ~~while that~~ /provided None Impeach ~~not~~\ Impenetrability p<sup>r</sup> And consequently that it may be boundless as well towards Imensity, as smallness. Any of these states affirmed of body may justly /be\ supposed as true, In all Infinity of degrees, becaus they are Consistent with y<sup>e</sup> Essence of body\*<sup>297</sup> ~~Hence it is that~~ ~~However~~ It is Not in our power to prosecute deviations beyond the ~~power~~ /distinguishing capacity\ of Sence ~~to distinguish~~, yet In our minds wee doe it, and also perceiv it May so continue to be done with Eternally; In like manner, with Mentall Multiplication, wee augment Space to Infinity of Extent; so that it is senceless to p<sup>r</sup>scribe any limits to space Either way, Since the Essence of it doth in no sort Restraine it, but rather Includes such capacity's; for when Space was created, It seem's necessary it Should be Infinite, becaus /otherwise\ Some odd being /wee know not what\ must also be created to Confine /terminate\ it, And No Imagination of ours can reach

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<sup>297</sup> Marg.: "\* so [much?], suppose any Quantity or figure for if it is not in Esse it is in posse;" see following note.

Aa. Indefinites

so Much as a possibility [ther?] Should be termes  
I doe Not allow /that\ In generall that our concepti=  
ons of ~~possibility, or Imposibil,~~ are a proof that Nature is [...?] No of Existences\, more  
then a posse

ad Esse valet.<sup>298</sup> But when Experience goes along  
with our conception, part of ye way, and meets  
with No stopp, It is a phi/si\call argument, that all  
the rest is so, And as cogent as /it is\ for ye Sun's rising  
to Morrow, or the Continuance of Mundane Systeme.  
Therefore I conclude that Space, by w<sup>ch</sup> I allwais  
mean body, Is Infinite In Extent, and devisibi=  
lity. D. Cartes tho meaning this, to avoid Cap=  
tion used ye word Indefinite; but I am to seek  
what just offence can be taken at the Notion,  
unless the Magnifying the Glory of ye Creation, & ye  
Almighty creator offends any. Surely it is a gre=  
ter act to make space, boundless, then Confined  
nor doth It trench on ye devinity as Hobbs abuseth  
it, ffor it is /of it self\ senceless, and Impotent, and a /meer\ slave  
to serve and Entertein ye Nobler creatures that  
thinck, and have /portions of\ it at Comand.

But I goe farther, and Suppose matter Not onely  
capable of Infite deminution, but also that it  
is actually small here or there, beyond any assi=  
gnable magnitudes; & this Small matter /is\ Intersperst  
In almost Every region, to accomodate ye smaller  
Spaces, & spondrells<sup>299</sup> y<sup>t</sup> will be In ye Interstitie's  
of Irregular Matter. ffor If curvesided or plane=  
sided

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<sup>298</sup> i.e., 'if it exists, then it is possible', usually 'ab esse ad posse valet consequentia', a term in schoolmen's logic.

<sup>299</sup> See RN's account of 'spondrills' in 'The World' (above), esp. f. 61v ff.

sided figures y<sup>t</sup> fitt not as tally's, be Intermixt, there are Spaces, In their cornerings, w<sup>ch</sup> must have a smaller matter In them, and the Same occasion is amongst that, w<sup>ch</sup> hath yet smaller to answer it, and y<sup>e</sup> like of that, & so In Infinitum w<sup>ch</sup> /this is what\ I mean when I speak of y<sup>e</sup> actual Infinity of minuteness. & the Consequence is this, that No Space /Interstice\ Shall happen any where so Small, but there shall be apt Matter to fill it and If y<sup>e</sup> Matter be Not Exquisitely apt, then the Spaces /Interstice\ Shall not happen /nor any\ but as apt matter be /a ready\ to accomodate /fill\ them. Whereby If perchance, there should Not be matter /so\ to accomodate Every motion, but that some may be /dissappointed\ ~~diverted for want of succedaneums (w<sup>ch</sup> from y<sup>e</sup> worlds plenitude I assigned as the Caus of Cohe= sion in Cohesion of body's yet there is & Will be Enough to Reconcile y<sup>e</sup> action's wee are sensible of in y<sup>e</sup> world. And If Such Impedim<sup>t</sup> of Motion doe happen, from such caus, it doth ~~but~~ correspond/s but is\ better with y<sup>e</sup> phenomena of y<sup>e</sup> world; for wee must observe, tho In generall /many\ thing's take Neer to a Regular Cours, yet None is Exactly so, the orbs of y<sup>e</sup> planets, the times of their Motions, the Sun's face, /with its macula & faculae\ &c, are all Irregu As to Exactness Irregular. /And w<sup>t</sup> matters it, If two body's doe not part from such occasion, 3. or multitudes, but clott together still y<sup>e</sup> [action?] acts on them as wanted according to its caus, and here I find caus to charge cohesion partly on matter failing to accomodate motion.\~~

Now that this Subdivision of Matter, doth accomodate motion, If Not Exquisitely, yet Sufficiently  
for

## A.c. Indefinites

for y<sup>e</sup> /worlds\ porpos, will be manifest, if It be conside=  
 red, as before was toucht, that when angular  
 opening's were /happen\, as A. c. B. (y<sup>e</sup> world being full)  
 <diagram> to make way for A. & B. to devide, Mat=  
 ter must be protruded, and at y<sup>e</sup> Same time  
 a space is made to receiv it. Wherefor  
 the parts being Intermixt of all Inferior Mag=  
 nitudes and formes, in continuall action as flu=  
 ids are, must needs returne y<sup>e</sup> action round from  
 the first mover crouding to the derelict space  
 [Receing?] it, where the matter is adapted with y<sup>e</sup>  
 Multiplicity of the magnitudes & Shapes y<sup>e</sup> Matter  
 May justly be supposed to have. Wherefore it is  
 a senceless thing to say Motion cannot be if  
 y<sup>e</sup> world be full, becaus room must be made, be=  
 fore a body Can Move. It is fals, for it is done at  
 one and y<sup>e</sup> Same time, & that Serves turne. I would  
 Ask when a staff is moved Endway's, whither it  
 is necessary some part's Should detach, & goe before  
 to make way for those that follow; Is it Not Enough  
 to goe together? And to say, as some doe, If the  
 world be full, there cannot be those turnings &  
 opening's of Matter as wee know must be ac=  
 cording to the phenomena, and /that\ therefore ple=  
 nitude & motion are Inconsistent, Is as vaine as  
 y<sup>e</sup> other, ffor why May Not Matter be fine Enough  
 since they cannot deny but it may fine to  
 Infinite

Infinite to Supply the occasion? I must confess I never observed ~~nothing~~ /any thing\ more loos & triviall among the vertuosi then the p<sup>r</sup>tended demonstration's ag<sup>t</sup> Motion w<sup>ch</sup> Every babling tongue, and a Cuff on y<sup>e</sup> Ear, ~~as~~ /(in y<sup>e</sup> Method of\ an old philosofer<sup>300</sup>) confutes: besides If wee gave them their Intersperst vacuity's, motion was No more accomodated the before, as was before observed, from the crowding of y<sup>e</sup> Mundane Matter from the center's of their Movem<sup>ts</sup>. I am Sure there can be ne difficulty of motion conjected, w<sup>ch</sup> will Equall authority is Not answered, by this actually Infinite Smallness of bodys, And ~~that~~ /so is\ the Method of y<sup>e</sup> Sensible world; ~~is~~ for the Interstitie of Grosser partes, to be filled with Minuter matter, as sand among stons, water among sand, &c. what Should stop the process in Infinitum. I am Sure it is Most reasonable to carry on a ~~process~~ so /that\, then to Invent thing's of w<sup>ch</sup> there is Either no Evi=ence, or necessity, as vacuum & Qualitys

There have bin many Sofisticall puzzles Invented to oppose, or rather deride this notion of Infinite devisibility, but most are so puerile & trifling as Not to deserve notice; the most serious author is he of the origination of Mankind,<sup>301</sup> that adds Substract's devides & multiply's Infinity, and thincks so to make /shew\ a trojan hors of Contradic=tions, ~~In Infinite, Eternall, &c.~~ I Shall /ans<sup>r</sup> all\ onely  
by

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<sup>300</sup> Diogenes (c.412-c.323 BC)

<sup>301</sup> Sir Matthew Hale (1609-76), *The Primitive Origination of Mankind, considered and examined according to the light of Nature, ...*, London, Printed by William Godbid for William Shrowsbury, 1677.



A.e. Indefinites,

by proposing that Noble adumbratory<sup>302</sup> Ins=tance of Infinity, the figure Hyperbole with its asymptotes. The property of w<sup>ch</sup> is, how=ever neer you place them, ~~by~~ /they shall\ being extended ~~they shall~~ Eternally approach ~~but~~ /and yet\ Never touch, So that the space, litle as was supposed, is subdivided to Infinity with a wittness. And here Infinity of Extent, & Infinity of deminution concurr in the Same progression, & demonstrate Each other.

An Hyperbole ~~is given by~~ /Results from\ the Section of a Cone by a plane parallel to the axis; If the Section be in the axis, y<sup>e</sup> figure is a tryangle, but If it be never so litle out of the axis, It is an hyperbole. as y<sup>e</sup> Cone. A. D. C. cut thro y<sup>e</sup> axis B. D. <diagram> makes a triangle but If out of the axis, it is an hyperbole, f. e. g. The asymptotes are the Extreame of the Cone, or the triangle (Supposing y<sup>e</sup> Section to be in y<sup>e</sup> axis) /usually taken as\ projected on the plane of y<sup>e</sup> hyperbole /but really in y<sup>e</sup> plane with y<sup>e</sup> axis\ as. a. d. c. are the asymptotes. and becaus the section is parallel to y<sup>e</sup> axis and that and y<sup>e</sup> asymptotes are in y<sup>e</sup> Same plane, axis and asymptotes, are paralell and Can Never touch or, Intersect. So make y<sup>e</sup> Section as Neer the axis

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<sup>302</sup> This could be read as 'adumbrators', i.e., referring back to Hale's imputed definition, both readings make a sense.

axis as May be, let it be neerer then any assign-  
 able distance (w<sup>ch</sup> Mathematitians put  
 for Infinite) I say, If this cone, So Sectioned, were  
 Extended from y<sup>e</sup> cusp. d. to Infinite distance  
 the Hyperbole, & the asymptotes (/also\ projected in  
 y<sup>e</sup> same plane, as upon this paper) would be  
 also Extended to Infinite, & be perpetually neer-  
 er, and yet /y<sup>e</sup> ~~progression~~ /y<sup>e</sup> approach\ created from\ this less then any assignable dis-  
 tance of y<sup>e</sup> Section from y<sup>e</sup> axis, y<sup>e</sup> creates this /the\ ap-  
~~proach and /w<sup>ch</sup>\~~ at the Inception of it, neer y<sup>e</sup> Cusp,  
 is rather less /being, not much as little as can be Imagined,\ Shall deminish in Geometrical  
 pro-  
 gression along with /as\ y<sup>e</sup> Cone /Increaseth\ to Infinite. If truth  
 had wonder, this were a miracle, but y<sup>e</sup> why  
 Should any thing be thought Strang, that is demon-  
 strated to be true? ~~It may be that~~ truth's may be  
 Surprising & new, but Never should be thought  
 Strang, Every /All\ thing/s\ ~~Naturally being Equally~~ /In nature\  
 once knowne, are Equally y<sup>e</sup> Subject of wonder,  
~~w<sup>ch</sup> is~~ but /It is in truth\ of one thing /onely\, the Great Author of it.  
 I must Confess that In Every length, the same spe-  
 culation of Infinite devisibility holds, but it is In  
 No projection So layd before the Ey's, & made as  
 it were Sensible, as In this of the symptotes,  
 And that /shall\ closeth this discours of devisibility.  
 <flourish underline>

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1..

Things of constant and obvious notice are most lyable to mistake from p<sup>r</sup>judice.<sup>304</sup> ffor childhood, that first observes, is credulous, and of Nothing More, then that sensible objects are in themselves, the same, as the Image Impres't on them, w<sup>ch</sup> is so far from being at any time, that it is really, Never true; w<sup>ch</sup> ~~Matter hath fallen under Exami-~~  
~~nation Elsewhere.~~ Thing that /are\ first p<sup>r</sup>sented to mature age, fall under a strickter Inqui=  
sition, and much Questioning is Comonly had about them. but the Quotidian Impressions of sence administer vulgarly litle doubdt or Inquiry, and doe not seem to have any science or Mistery In them. for familiarity Goes for understanding, and to Explaine a thing, it is /ordinarily\ Enough to Shew it is like some=  
what /Els\ that often occurs to us. of w<sup>ch</sup> Sort was much, If not Most of y<sup>e</sup> ancients philoso=  
phy. And for the same reason it is, that as science Enters In No speculation with More strife and opposition, then /of things\ ~~these~~ the sences have p<sup>r</sup>posses't, so /And\ to argue that thing's are Not what they seem to be, Stirrs y<sup>e</sup> spleen, and is almost a caus of Civill warr. Wittness the moderne Systeme of y<sup>e</sup> World, Setting y<sup>e</sup> Earth a whirling among y<sup>e</sup> planetts, & Giving y<sup>e</sup>  
sun

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<sup>303</sup> This essay, which runs for 32 pages, to f. 262v, is written on porous paper, giving rise to problems in reading, since marks made on one side of the sheet obscure those on the other. The writing is often very faint (this may be intentional, to overcome the problem of ink soaking through), and in places small and cramped. In fact, this is one of the more difficult to read essays in the volume.

<sup>304</sup> Marg.: "Dissolution of comon p<sup>r</sup>judice"

2..

Sun as a fixt Starr, the p<sup>r</sup>ogative of keeping  
 its post. but to waive those Mighty reaches  
 of Discovery; lett us keep at home among the  
 litle trifles about us, where wee find, the Same  
 p<sup>r</sup>judice fighting ag<sup>t</sup> truth. tell a Well Educa=  
 ted person, I may say scollar, or ordinary  
 devine, that there is No colour In the Dark,  
 crimson, Green, or blew are Not In y<sup>e</sup> object,  
 but In our Intellects onely, and /but\ the occasion  
 onely from y<sup>e</sup> object, & he shall draw his Elo=  
 quence and with passion attaq you. So ffor  
 objects of y<sup>t</sup> palat, & Ear. These being capa=  
 ble of proof by argument Even to demon=  
 stration, I have thought to Single them out  
 to be declared, supposing other truth's of like  
 Nature, If these may be Enterteined, will More  
 Readily be admitted.

I Shall pass by what ~~shall~~ may be observed  
 from the Skill of perspective, by w<sup>ch</sup> wee judg  
 of Magnitude and distance of thing's, wholly  
 different from their appearances, and Insist  
 on this Single thought.<sup>305</sup> there are In Sence I=  
 mages of thing's, w<sup>ch</sup> are Not in rerum na=  
 tura<sup>306</sup> without us; and here /also\ I pass by all that  
 may be Noted from Reflection's & Refractions  
 of light, ~~Noting~~ /laying hold\ onely /on this proposition.\ that Confusion is an  
 object

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<sup>305</sup> Marg.: "Sensitive appearances, are Not in y<sup>e</sup> Object"

<sup>306</sup> i.e., 'natural things'.

3..

object of sence, and /that\ Nature /itself\ knows No con=  
 fusion; ffor all thing's, however they appear  
 to us, are distinct & Simple. let there be a  
 mixture of Corpuscles that Exhibit to us y<sup>e</sup> colour  
 yellow, with others, blew; the Result to our  
 sence is Green; But If you goe to the thing  
 or object it Self Either Mentally, or with help  
 of a Microscope, there will Not be found /so much as any\ one  
 Green Corpuscle amongst them, but Each of  
 y<sup>e</sup> former hath its hew as distinctly yellow  
 & blew, as they had before y<sup>e</sup> Mixture, or as any  
 body's can be distinctly & Simply coloured. this  
 is pleasant Enough to observe, In y<sup>e</sup> Ingenious  
 Mixtures tradesmen use to sett off Ribbon's and  
 Stuff's, especially such as they Call changeable.  
 w<sup>ch</sup> however singular & variable to y<sup>e</sup> light,  
 view<sup>d</sup> in a Microscope consist only of the Simple-  
 coloured threds crossed~~ing~~ In various dispositions  
 by y<sup>e</sup> weaving; w<sup>ch</sup> And for want of /an exact\ distinction, as  
~~so Exact~~ by y<sup>e</sup> Naked Eye, are /appear\ all blended In a  
 sort of Confusion, & ~~se~~ produce an Image to  
 the perceptive faculty, that Subsists No Where  
 Els. The same is true In sounds & other sensibles.  
 what is more purely Continued then the voice  
 of a Nightingale, or y<sup>e</sup> Sound of a musicall  
 string or pipe; and yet the smoothest of those  
 are found to consist of distinct pulses Repeated  
 in

4..

In Equall spaces of time, w<sup>ch</sup> y<sup>e</sup> sence discernes not. So the consequence Gratefull, or unpleas<sup>ant</sup>, Is Not in the thing, for there wee find No<sup>thing</sup> but pulses in equall, or justly propor<sup>tioned</sup> times w<sup>ch</sup> are pleasing, or pulses Irregular & unaccountable, Such as y<sup>e</sup> Creaking of wheels or doors, w<sup>ch</sup> is very offensive. And out of these pul<sup>ses</sup>, as art hath found to Manage them, proceeds that Idea Wee have of harmony; w<sup>ch</sup> is a /capacity\ beau<sup>ty</sup> ~~in~~ /of our\ nature really of amazem<sup>t</sup> and wonder, but without us hath No other foundation then as simply striking /upon\ a stones, and yet fills the very soul with celestiall joys.

I need Not Inlarg In Farther Instances, the No<sup>tion</sup>, that these sensible Ideas, are not Existent In y<sup>e</sup> objects, but In y<sup>e</sup> Mind that perceives them;<sup>307</sup> is So demonstrated by these, ~~that~~ as thro the whole sensible world to Convince us unniver<sup>sally</sup>, that Ideas are created by /or Subsisting in\ y<sup>e</sup> perceptive faculty onely and Not in the object. And that If the almighty had Created No living or sen<sup>sitive</sup> creature, there had bin No Such thing /in y<sup>e</sup> World\ as colour, tast, sound or any other Image of things as wee perceive them by. Therefore our method of justly understanding the Nature  
of things

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<sup>307</sup> Marg.: "The world to be considered apart from sence."

## 5..

of things in y<sup>e</sup> Sensible world, is to Abstract all our Idea's, the creatures of our perceptive faculty, and to consider, what they /objects of sence\ are in themselves, If /in case\ No perceiving creature had Ne=  
/E\ver bin created.

That y<sup>e</sup> objects, and its /their\ various ~~dispositions~~ /circumstances\ of position, Mixture, & Motions, are the causes of those Images /Ideas\ they occasion In our Imagina=  
tion; ~~So~~ is Most true;<sup>308</sup> but Not that they have In them any thing of that w<sup>ch</sup> wee perceive.  
As the circumstances of body chang or vary so our Ideas vary, and constantantly are atten=  
dant in like manner, on y<sup>e</sup> Same circumstan=  
ces of y<sup>e</sup> object. so that when y<sup>e</sup> Same Idea's occur In our Imagination, wee argue & true=  
ly, the same circumstances of y<sup>e</sup> object /to be p<sup>r</sup>esented\. there=  
fore wee call some light, other's colour, o=  
thers sound, and ye like with all their vari=  
ety's, w<sup>ch</sup> move & are Imprest by Contact on our organ ~~from~~ /thro\ ye action of y<sup>e</sup> Medium derived from sensible objects variously cir=  
cumstanced. w<sup>ch</sup> being of constant Notice & observation, by a Sort of Infantine p<sup>r</sup>judice wee ascribe wholly to the Object's that are found allwais to occasion them. And as a certein valediction to all this p<sup>r</sup>judice, take one Re=  
marg more, w<sup>ch</sup> is a match for all sceptick Caviil.

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<sup>308</sup> Marg.: "proof y<sup>t</sup> Images of sence are Not in y<sup>e</sup> objects."



6..

A stroke on the head May be with, a cane  
 A brush, or a Saw. Either of w<sup>ch</sup> occasions an  
 offensive Idea, wee Call paine, Each as litle  
 like y<sup>e</sup> other as those things are that Caus it.  
 And when the Cane smites, wee know it, as well  
 as by y<sup>e</sup> Sound, wee know a bell, So for the  
 brush or Saw. Wee cannot say that these sharp  
 paine's (for such are y<sup>e</sup> Ideas,) are in y<sup>e</sup> Cane  
 &c, but In our perceptive faculty onely, tho  
 the Cane &c, caused it. The Same is true in  
 other Instances of weaker, or more Indifferent  
 perception's, a /or?\ more or less force or Effect, vary's  
 Not y<sup>e</sup> Nature of things; so when light, colour  
 or sound Strikes our Sence, wee perceive it, un=  
 der a Certain Image, tho Not painefull, &  
 perhaps pleasant /or Indifferent\ w<sup>ch</sup> is in us, & Not In the  
 body's that caused it, No More then paine  
 is In the cane, brush, or saw w<sup>ch</sup> Smartly ap=  
 plyed was the occasion of it. I have concluded  
 with this gross, & If I may so say, Substantiall  
 Instance of basting, and the paralell, as  
 what I thinck cannot be Contradicted. And  
 this argues to y<sup>e</sup> whole frame of Nature, or visible  
 world, that out Ideas occasioned by Externall  
 objects are onely within us, and the Nature of  
 thing's is to be collected & knowne by other  
 measures then those of Immediate sence.

## 7..

All the notice wee have of the World and what is contained in it, is had thro y<sup>e</sup> Mean's of our senses,<sup>309</sup> And those are to be considered in two Respects, 1. the Impression's upon y<sup>e</sup> organ, & 2. the Ideas from thence formed in /o<sup>r</sup> minds\; I may add a. 3<sup>d</sup>. the Judgm<sup>t</sup> or Conclusion's wee draw from them. The 2. first are undoubdtedly certein & without Error, but y<sup>e</sup> last is almost wholly offuscate in Error & Ignorance; the clearing of w<sup>ch</sup> is the Subject of our Celestiall faculty of reasoning.

1.<sup>310</sup> the Impression's from without may Either be from Externall object's themselves moving the ~~organs~~ organ's of sence, & by [nerves?] /nerves\ & un-knowne tracts derived to the seat of perception. this is called Immediate Sence. the or Els from the movements or posture of those Nerves or Secret tracts & Recessed Recesses of y<sup>e</sup> body, y<sup>t</sup> have bin formerly so Imprest, and afterwards, as water disturbed, faintly undulate, or Represent the like movem<sup>ts</sup>, as originally gave y<sup>e</sup> sensation, whereby the Images of it are againe perceived tho faintly, & this wee call Memory. It is No wonder that thes /things are\ as Not better Explained becaus, the very seat of Sence is Not Nicely discovered, Much /less\ y<sup>e</sup> Manner of the Conveyances to it; I have nevertheless Essayed Some= what of them. It is Most Certein that these  
movem'ts

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<sup>309</sup> Marg.: "How wee come to know y<sup>e</sup> world."

<sup>310</sup> Marg.: "The Nature of Sensation"

## 8..

Movement's are really and truly Existing In body at the time of our perception from them. but what they are, And how y<sup>e</sup> Effect works, is another Question.

2. The Ideas we have within us, Excited or occasioned ~~from these~~ /by Externall objects, Either as Immediate Sense or Memory, are No way to be described but by Referring to the things themselves, w<sup>ch</sup> Every one, that lives, knows. as colour, tast smell touch, Sound, ~~pleasure, paine, fear, & all passion's~~, & y<sup>e</sup> like. None can describe blew, or y<sup>e</sup> Sound of a bell; but all knowing them, and Naming every variety, understand Each other discoursing of them. as when all agree any one thing to appear as they call the appearance, Blew, then the same or like, tho under degrees of more & less almost infinitely subdistinguisht, are all Called, blew. Now Nothing is More certain then that we have these Ideas within us, while we perceiv them. and it is In vain to goe about, by giving hard Names, to declare what they are, for they are undoubtedly what they seem, & Nothing Els. this brings Me to the 3<sup>d</sup>. Respect that is the Judgm<sup>t</sup> we give, and conclusion's we draw from them, and In this Respect onely is humane Nature fallible. our senses, or Imagination doth Not deceiv us, but our hasty & Immature unweighed Conclusions from them are so fallacious that we have [Scare?] a just opinion of any thing without us.

As to Instance,<sup>311</sup> that light is derived from y<sup>e</sup> Sun, & wee have the Idea of it, as covering a certein Space in y<sup>e</sup> Sky, is most certein /&\ true, but that it is No bigger then a cart-wheel is Error of Judgm'<sup>t</sup>, w<sup>ch</sup> /in y<sup>e</sup> [Case?] being\ regulated by art & Expe=  
 rience /It\ is found vastly to Exceed y<sup>e</sup> bigness of the whole Globe of Earth. So when the Idea of a man occurrs, wee strait argue & Conclude there is a man, where he seem'd to be; and for y<sup>e</sup> Most part it May be true but very often fals. as when it is by Reflection from a Glass, or In a dream. And this is to be sayd of all phantasmes & spectres, What Ever power is sufficient by Moving the part's of our body's to administer Ideas to our perceptive facul=  
 ty, Need Not amass together such heaps as is Requisite to forme y<sup>e</sup> objects reall as they Seem, as for Instance, to Rep'sent Parnassus /With Apollow\ and all the muses; or So Much as would Make up the person of one dead, or other Gross thing's weo=  
 men & children Call spirits, but by a slight touch upon Some part of our body's neer y<sup>e</sup> seat of perception, Exhibite In the space of a pins ~~point~~ /head or less\ all these Images, as well as an whole landscape is p<sup>r</sup>esented upon as Small a mettaline convex In y<sup>e</sup> Newtonian telescope. therefore Men are Not to conclude things  
 appearing

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<sup>311</sup> Marg.: "Sensations are true, but our Inferences fals."

10..

appearing In y<sup>e</sup> Imagination are really Subsisting without us as they appear, unless wee have reason for the Making Such Conclusion. And very often there is reason to Conclude y<sup>e</sup> Contrary as In dream's & phantasmes, or Representation's of thing's not Consistent with y<sup>e</sup> laws of body found & approved by Continually and universally Experience; of w<sup>ch</sup> In due time.

I am so farr here from derogating from the beleif of the distinction of soul, and body;<sup>312</sup> on w<sup>ch</sup> our Religion, and hopes of an happy future State depend, that I thinck I have found a demonstration of it; at least so farr as confutes and Confounds its adversary's, and Makes way for our holy Christian faith, by Shewing that their objection's are futile and fals. And this is from the most Notorious and certain Ideas wee have that cannot be in body. ~~that is~~ /& have bin observed for Instance such as are caused by\ Confusion; for there is /, as I s<sup>d</sup>\  
No Confusion in the material world. but Each thing ~~as was sayd in~~ it is limited and distinct. ~~but wee have~~ /and\ Ideas /also\ that grow out of confusion of things; /are no less In our sence distinct such\ as Mixt Colours & Sounds, ~~of w<sup>ch</sup>~~ /altho\ the Ingredients /constituting\ of /those\ colours & Sounds, ~~being~~ /are [all?]\ In themselves /various & yet also\ most articulate & distinct ~~have Nothing /like it\ of.~~ as where will you find in the mixture of yellow & blew, a speck  
of

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<sup>312</sup> Marg.: "proof of Spirits"

11..

of Green, or In y<sup>e</sup> Conjunction of thirds & fifths  
 In Musick y<sup>e</sup> Idea wee have of harmony.  
 Then If these consist Not In body, It must bee,  
 that Since, they doe Consist, it Must be in  
 somewhat Els, wee call y<sup>e</sup> Mind or Soul  
 onely w<sup>ch</sup> is capable of perceiving. I would  
 ask, If wee have Nothing but Materiall sub=  
 stance to act & thinck, and Such is Ever dis=  
 tinct & articulate, that is, the greatest and  
 least thing's have their Essence & limits Equally  
 apart; for body is found Impenetrable, & can=  
 not Mix Substances, how constant a thing as  
 an Idea w<sup>ch</sup> is actually /None of y<sup>e</sup> Item's [y<sup>e</sup>?] caus it, but [new?] from\ a mixture, be wholly  
 in body? Then When that Refuge, of body  
 doing all, is Confounded, and it is shewed things  
 are done, that is perceived w<sup>ch</sup> are Not, &  
 cannot be in body, but somewht Els; /Such as\ we  
 call our Soul or mind, a being capable of  
 perceiving, /or rather receivings\ such Ideas; And then What beings  
 that are Not body, May there Not be in the  
 university of thing's. And why must Such  
 beings, however annexed to body, Necessarily  
 dissolve, when the Constituent part's of that  
 are a litle dislocated? to Conclude, If there  
 Were No other argument, this w<sup>ch</sup> I have proved  
 of Mentall Ideas Not subsisting of body, /in y<sup>e</sup> object\ is a de=  
 monstration, that the Mind or Soul is a being distinct  
 and

and Indipendant on body, however it Comes to be this Miraculously Connected with it ffor some Short continuance of time.

To proceed then with the Consideration of our Reasoning faculty, as it Respect's outward objects, or Sensible things;<sup>313</sup> I must observe that as wee have mean's In great measure whereby to Regulate ye obvious Errors and prjudices that grow up in the Cours of o<sup>r</sup> lives, yet for want of Needfull discovery's, w<sup>ch</sup> they call Experiments, wee doe Not comand a clear knowledg of the univers, and to say truth but of very few thing's /in it\, and /those\ such as are near, & continually about us. And all in different degrees of probability, Some more & some less, and scarce any In absolute certainty, but our Immediate Sensations and what is Included In them. Of that sort are the mathematicall ~~Seiences.~~ ~~scin~~ sciences, Wherein Resides all humane certainty of Naturall thing's deduced by reasoning. W<sup>ch</sup> is Compassed by Reducing Complex propositions to the Immediate & distinct Sence of things. as when wee have a sence of one thing It is Quatenus a totum,<sup>314</sup> w<sup>ch</sup> compriseth & is Equall to all its parts, and accordingly may be supposed compounded or devided  
in

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<sup>313</sup> Marg.: "of discovery's, & first mathematicall."

<sup>314</sup> i.e., 'as far as the whole'

in any Manner, Still Included in y<sup>e</sup> Idea of one and the same. as to Shew; twice. 2. is equall to four; the object of sence is four, y<sup>e</sup> totum; any Space or Quantity whatever, Mentally devided into. 4 parts, w<sup>ch</sup> also Constitute y<sup>e</sup> whole. And in this Respect, Equall, & the same, are In y<sup>e</sup> Mind, as it were all one, so as to say, one thing ~~is~~ equall to another, is equivalent as saying it is the Same. that is the mind putts one to y<sup>e</sup> other, and finds them Congruere,<sup>315</sup> w<sup>ch</sup> is a legitimate demonstration, and If they are, In hypothesi, divers yet ~~N~~ In Mentall Congruity they are the same; w<sup>ch</sup> bring's /all for proofs\ to that point affirmed, that a sensation of any materiall thing is true. This Instance of  $2 \times 2 = 4$ . is Easily conceived in y<sup>e</sup> mind; becaus the organick capacity of o<sup>r</sup> body will contein such Ideas as of .2. or .4. without confusion; and so /wee may\ Collate the whole & y<sup>e</sup> parts, giving them proper Names as In Mathematick arts ~~are~~ /is\ knowne, and by that Mean's ~~forme~~ axiom's, theorems, & propositions are formed, w<sup>ch</sup> answer all cases of [Quantityty?] of like Supposition. As If it be affirmed. that the .2. parts of a Quantity bisected, are Equal to the whole undevided; the mind takes an Idea of Quantity, and Reflects  
that

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<sup>315</sup> i.e., 'harmonized, congruent'



## 14..

that they Must be Equall for they are the same. Thence the axiom that the whole is Equall to all its parts, is Setled for an univrsall truth; applicable to all Quantity whatever. So body's that agree in all points are Equall. for Every Quantity doth but agree with it self in all points: from hence If you find all the sides of a figure/s\ are Equall & alike It argued the Content/s\ is /are\ Equall. Consequently add or substract Equalls to or from Equalls the Rests are Equall. And divers others w<sup>ch</sup> Ma<sup>=</sup> thematitian's build upon, are If duly Considered Resolved Into y<sup>e</sup> Idea of a Single Quantum; or sensible object. and so /thus\ Simple sensation is the basis of all mathematick verity, so farr are our senses from deceiving us.

Before I goe farther, I would have the Extent of humane Capacity well Considered, for It will appear that all our failings in comon judgement of thing's grow out of defect's there.<sup>316</sup> It is certain that our sensation's are Received thro the Interposition of body's, and particularly that Machine wee claime y<sup>e</sup> Governm<sup>t</sup> of /& call our owne\ The consitution of that is Such, (At p<sup>r</sup>sent No matter how Or why,) that wee can move our members, but In a certain manner; and with a determined Celerity. as the hand of /an\ Expert musitians

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<sup>316</sup> Marg.: "The Extent of humane Capacity."

musitian Moves with a Swiftnesse that Exceeds  
 perhaps any other actions men use, but yet  
 Not so Swift, as the pulses of his Sounding String.  
 others that observe that motion follow it with  
 their Eyes, and In some manner keep them  
 company, but y<sup>e</sup> Eye Cannot follow in the  
 Swiftnesse of the vibrations of a string that Sounds.  
 So Men that count any thing passing, Either  
 by nodds or motion of y<sup>e</sup> hand keep company  
 with them, and If they pass faster then those  
 nodds will distinguish, the account is lost.  
 If body's, as dyce, be lay'd on a table, If the Eye  
 can pass from one to y<sup>e</sup> other & Returne in time  
 to and againe, as may Collate them, there will  
 be a [Compretion?] of them as, of 2. 3. 4. and  
 So perhaps to. 10. But If there be more, so that  
 the parts of y<sup>e</sup> body, that subserve to y<sup>e</sup> sence,  
 looseth some in passing to other's, looeseth then  
 as to [→→→] an united Comprehension of them  
 y<sup>e</sup> Capacity fails; and hath but a confused Idea.  
 The consequence of these defect's (If I May So Call  
~~the~~ /our\ Corporeal powers, tho Regulated by y<sup>e</sup> laws  
 of body, w<sup>ch</sup> are perfect) is, that If Motions have  
 Returnes Swifter then any Motion of our bodys  
 can keep pace with, all distinction ceaseth, &  
 y<sup>e</sup> Idea is confused, and the sensation is as off  
 a thing continued. So wee distinguish the mo=  
 vement of y<sup>e</sup> Musitian's hand's, but Not the vi=  
 bration's of his Strings; and the like. And of this  
 what

what was Noted of the idea of Number, is a Remarkable Instance. for we cannot form a distinct Idea of Many things, and it is from the dullness of our materiall Engin; that we cannot doe it. therefore when we come to. 10. 20, 100, 1000 & the like, we are at a loss, and are forc't to leav Imediate Sens, & Repair to art such as we call Arithmetick to help us out. we may well Imagin an angel to comprehend 100000, as distinctly as wee. 4. Suposing ~~it~~ him to be fitted with organ's capable of Movements proper for it. and So ye Almighty whose capacity is Infinite, comprehends distinctly every minute particle in ye univers, and being's spirituall, as well now as in all time past & to Come; with one Intuitive act.

It is Not difficult to Conceiv how arts have bin accomodated to supply these defects.<sup>317</sup> as Arithmetick, In the buissness of Number, w<sup>ch</sup> is but an Idea of Equall Quantity's; or of one, reiterated, by Establishing the rules, upon Experiments In few & easy cases, by w<sup>ch</sup> the most abstruse and complicate are Resolved, for. If ~~2. More~~  $2. + 2 = 4$  /so is\  $200 + 200. = 400.$  & ye like. and the same is done In Geometry, w<sup>ch</sup> considers magnitudes without number, In the process of w<sup>ch</sup>, methods are Establish'f for comparing & resolving cases of Quantity that might well  
be

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<sup>317</sup> Marg.: "Arts are but helps to defects of Nature"

17..

be, from the prodigious perplexity With Respect to comon capacity, as men may fancy, Magicall or Supernaturall as If men dealt with demons to In= forme them. Hence are the celebrated arts of Arith= metick & Geometry, and /the\ 2. Methods of preceding, one Called synthetick, or moving from y<sup>e</sup> Axioms to the proposition's, y<sup>e</sup> other ~~synthet~~ analitick, or moving from y<sup>e</sup> proposition to y<sup>e</sup> axiom; w<sup>ch</sup> is So farr more Efficacious then y<sup>e</sup> other, as under y<sup>e</sup> Name Algebra, is accounted the [Qelinen?] of humane understanding. And herein is Great ostentation & Glory, as If Humaneity were Ex= alted by the capicity of untying perplext Com= position's, with tedious Indagations & processes whereas in truth it is but demonstration of Incapacity or defect. ffor were it Not more Glo= rious to prove an Intricate theorem of Curves, by plaine Intuition, as wee doe  $2. + 2. = 4.$  ra= ther to drudg as men have to doe, spending y<sup>e</sup> best time of their lives, and ages to find them out.

The boast of these arts, is as of a standard of all Reason & Knowledg, and that w<sup>ch</sup> is called de= monstration in them is obtruded upon Every o= ther science, w<sup>ch</sup> and learning,<sup>318</sup> Every one of w<sup>ch</sup> Now claime to proceed more ~~geot~~ geo metrico as If all their Stepps were in the way to demon= stration: And all this whither the subjects are of Quantity or Number or Not. And hereby No litle service has been done, by Instituting faster  
steps

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<sup>318</sup> Marg.: "demonstration, belongs onely to Quantity."

Steps of arguing, that is from things more, to  
 others less simple & plaine, w<sup>ch</sup> is done better by  
 observing the reality, then following y<sup>e</sup> forme. for  
 Nothing is More fulsome, then /using\ the props. probs  
 lem'. Coroll',<sup>319</sup> &c in arguments of civil or political  
 cases, w<sup>ch</sup> cannot be drawne /downe\ to Simple Sensations  
 of thing's. but depend on principles as perplext  
 and dubious as the cases to be proved, and as folks  
 are p<sup>r</sup>judic't one way or other Either In opinion  
 or Interest, so y<sup>e</sup> Argument is like to Succeed or  
 Not. Nor doe I altogether approve the Geome=  
 trick method, in Some of the Sciences called Ma=  
 thematick, as y<sup>e</sup> optick & mechanick, whereof  
 the Events, may be more or less uniforme, but  
 never Exact; As No Glasses are true ground, No  
 medium's Exactly alike; and the rules of the  
 acceleration of falling body's, In the proportion  
 of squares and of humids projected at a foramen  
 or Bombs from a Mortar, to Move In parabola,  
 may Come neer, but Never be Exact; and In Short  
 Nothing that depends on practick Event is so,  
 therefore Not within y<sup>e</sup> Survey of demonstration.  
 The most is but probability, of a superior degree.  
 But as for phisicall truth's, Such as the moderne  
 Systeme of y<sup>e</sup> world, chimistry, & y<sup>e</sup> causes of Com=  
 mon thing's are wholly unfitt for that Method,  
 tho some have bin very Industrious In it, and  
 the beginner was Cartesius, followed by M<sup>r</sup>  
 Newton

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<sup>319</sup> i.e., 'proposition, problem, lemma, corollary', the system of mathematical reasoning.

Newton, and y<sup>e</sup> Cry seem's to Run that way. Wherein that w<sup>ch</sup> I most Reprove, is the using or p<sup>r</sup>tending to use y<sup>e</sup> method thro-out and not Confining it to such parts of Nature, as are more suitable then the Rest, as for Instance y<sup>e</sup> law's of Motion, w<sup>ch</sup>. doe coincide with Quantity so much, as to be Examinable by y<sup>e</sup> Same rules, and Method, and treating the Rest but as probabilitys. In this M<sup>r</sup> Newton is less p<sup>r</sup>suming then Cartes, but More assuming in his principles. w<sup>ch</sup> Matters being here but toucht may in other place, be Inlarged on.

Then to proceed, I am next to Shew the power of our faculty's In helping ~~out of the dark as~~ /as to a better Information\ ~~that is the little Inf~~ /of naturall things then\ wee have Immediately from sence.<sup>320</sup> w<sup>ch</sup> will Never rise to that Exactness, as Quantity is treated with, and No higher then probability, w<sup>ch</sup> admitts all degrees of more & less, tho Some may have force to [uge?] with demonstration, and Render opposer's rather to be despised then argued with; /But\ others ~~probabilitys~~ /may\ fall So low as the humble accounts by Guess, is y<sup>e</sup> best can be Made of them. yet Even this order is Not to be despised; ffor acuteness as well as Integrity of Judgm<sup>t</sup> appear's most in that province. And If Great witts can steer clear of that fatall Rock most Splitt upon, over Confidence, Not to say Groundless & arrogant triumph, their Endeavours are most usefull & pleasant, and often light upon very Important discoverys. There is  
great

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<sup>320</sup> Marg.: "The power of our facultys In Search of truths."

great blame both In authors, & censurers, of Natural philosophy, The Authors If happy in any significant discovery's , of Whome, Cartesius was a nonpareil, they are not content to Cultivate them to y<sup>e</sup> best advantage, without launching out Into a sea of Conjecture, as he did; In w<sup>ch</sup> It is Impossiblye men can steer so stedy, but /they\ Shall bee fond and light, Spinning too fine, Especially p<sup>r</sup>tending to Resolve all doubt y<sup>t</sup> Ever were Moved. then on y<sup>e</sup> other side, those y<sup>t</sup> Censure are captiously given to select y<sup>e</sup> fondest and shallowest of conjectures, and thence shoot contempt on all y<sup>e</sup> Rest, the Most rational and Solid, but No More of this Now; It is Enough, If wee can former o<sup>r</sup> language to our buisness and when wee can demonstrate In a Style of mathematics; Els discours ~~selute~~ Solutely, & reason or Represent as y<sup>e</sup> Subject will bear, So If any shallow proposition is advanc't It may be slighted, & what is solid if any thing happen's so, Not p<sup>r</sup>judiced.

Then according to our p<sup>r</sup>scription,<sup>321</sup> abstracting all our Ideas, y<sup>t</sup> are /but\ creatures of our perceptive faculty, What doe wee find in the world, w<sup>ch</sup> wee can owne to Subsist without ~~is~~ /us\, consists of things passing to & fro. being sometimes farther, sometimes Neerer /asunder\ & sometimes together. By things wee must mean body or Quantum Qualified onely by keeping its place, & Not Increasing deminishing, or Intromitting to its limits any other thing. ffor all our means of perception, Informe us of that, and In Every Moment of time. Wherefore wee cannot be deceived so farr, as when one sence tells us. there is an Image of a Man , as  
Sight

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<sup>321</sup> Marg.: 'the Nature of things knowne by, Experim<sup>t</sup>.'

Sight in a Glass, and feeling tells us there is none there, & y<sup>e</sup> like, but there is no moment of time, or means of perception, w<sup>ch</sup> doth Not tell us, one thing will not penetrate y<sup>e</sup> place of another. Therefore this property of Body, is not the creature of sence, but y<sup>e</sup> Result of Experiment. a Certain Magnitude appearing May vary from truth as it is neerer or farther from us, for Neer it seem's larger then some other, and farther off lesser.<sup>322</sup> but Experimented by placing both together, or applying a Comon Measure, wee are not deceived, becaus the knowledg is from Experiment and Not from Sence. therefore whenever wee would Examine the discrepancy between appearances and thing's, wee must Not side with Either, but prove by such ways as Nature permitts, what y<sup>e</sup> one & other abstractedly is. let us therefore farther consider the Nature of Experiment. Wee perceiv by Sense, but know only by tryalls; ffor primarily from /bare\ perception, or sence, wee can onely conclude that wee doe perceiv, & nothing Els. But If wee Can Compass various way's of perceiving the Same thing, there results from thence a means whereby to Inferr Somewhat Els then bare perceiving. As Supposing a /farr\ landscape of forrest hills & water's; to one bredd recluse, it is but a gay /flat thing\, he knows not what; but a traveler /can tell y<sup>e</sup> distances & know's y<sup>e</sup> hills, trees, /&\ waters as thing's of his frequent acquaintance; w<sup>ch</sup> Could Not be If he had Not gon round & over them or their like. so this Idea In y<sup>e</sup> traveler is Not y<sup>e</sup> Same, as it is In the Recluse, and the difference is from y<sup>e</sup> Experience.

of

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<sup>322</sup> Has this got anything to do with George Berkeley, Essay 1709, Treatise 1710?



Of the latter; ffor things may be perceived at Se=  
 verall times at various distances, In different po=  
 sitions, by different organs; And then It May well  
 be argued, that any property that attends ~~any~~  
 an object, at all times, In all positions, distances  
 postures and means of observing it, that that  
 property is Not the Creature of our perception,  
 but of the thing it Self. for w<sup>ch</sup> there is this rea=  
 Son, different organs, occasion different means  
 of perception, and one organ cannot give the  
 Idea wee have by an other. as by y<sup>e</sup> Eye wee  
 see a bell. and with y<sup>e</sup> Ear wee hear it Sound.  
 Then when Either of these Ideas p<sup>r</sup>sents, wee thinck  
 of y<sup>e</sup> other, for In Experiment Memory is, is Equi=  
 valent to sensation. And the Collating p<sup>r</sup>sent  
 Ideas, with y<sup>e</sup> memory of other's past, is the most  
 ordinary Experiment Wee make of Sensible things.  
 And it is a property of Memory to rais y<sup>e</sup> past Idea  
 when any following sensation's of y<sup>e</sup> Same thing  
 happen. And Experimt is Not onely of the p<sup>r</sup>sent  
 condition of things but of succession's also; and hath  
 all degrees of Certeinty, of w<sup>ch</sup> y<sup>e</sup> most exalted In=  
 Stance I can give is that of y<sup>e</sup> Suns rising, w<sup>ch</sup>  
 wee Inferr, becaus it hath done so for 1000 years.  
 others of a lower order, belong to humane pru=  
 dence, and some to naturall filosofy, according  
 to the subject matter. So by Such Infinite proofs by  
 Experience, that things w<sup>ch</sup> strike y<sup>e</sup> Sence, or body  
 is Impenetrable, wee conclude that, In any  
 proof

proof as Can, or shall be made, the success will be as Ever it was; whence y<sup>e</sup> axiom /maxim\, that body Is Impenetrable; Not by vertue of any clear perception but by Inference or Conclusion argued from Multitudes of such.

But wee have No such argument, that there is any space, (whereof wee have an Imagination from y<sup>e</sup> Idea of body with a negation, as saying let No body be there.) w<sup>ch</sup> is penetrable. ffor there is No proof by any Experiment or tryall of it but men may opinionate pro & con ad Infinitum So that the Cartesian thought of Extension, & body, being one & y<sup>e</sup> Same thing, Is Not capable of being determined for or against him /but I am Inclined on his side\ ffor since wee know body is Extended, and No Extension, that is Not body, why Should wee from an arbitrary and Imaginary Negative, or any pr<sup>j</sup>udice of fancy, argue a being to Exist of w<sup>ch</sup> there is no better Evidence. And that there is No need of It, I hope may appear in time, And rather that it is Improbable from the Hypothesis of y<sup>e</sup> world I have to advance then otherwise. but yet I am no sectary for it, as to be listed among the plenists ag<sup>t</sup> y<sup>e</sup> vacuists, Such folly's being or Should be banish't filosofick Commerce; And such as faction it, and despise Each other, as civil mobb comonly doe, for different opinions, are of no better Extract or Education then they are.

## 24..

Now having Establisht for a foundation, that body, the onely object of sens, & that In appearance fills y<sup>e</sup> world, is Impenetrable, wee May allow that any state, mode, or condition of it, Consistent with that property is possible. And upon this will depend all the learning of Motion & Mechanicks hereafter to be discoursed of. As.

1. Infinity, whither In y<sup>e</sup> Extended limits of y<sup>e</sup> world, or In the subdivison or partition of body Either of them boundless, one in the way of Extent & y<sup>e</sup> other in the way of litle-ness, or devision It may be some may fancy y<sup>e</sup> world limited, and that there atomes, or a degree of Smallness that Cannot be actually Exceeded. and theres all y<sup>e</sup> argument for Either. This Infinity of litleness I call actuall Infinity, becaus It will be of use In Reconciling 2. great mistery's, the possibility of motion in pleno; and the continuity or firmeness of bodys. My reason ffor takeing this Side of Infinity, is that by all the Scrutiny wee Can make, wee discover, no symptome of limits Either way. how y<sup>e</sup> world is Inlarged, by y<sup>e</sup> late telescopian discovery's among y<sup>e</sup> fixt star's and the perfection found among Minutes by y<sup>e</sup> Microscopian observation's, both doe loudly pronounce, Et Sic in Infinitum.<sup>323</sup> And till Either some Experiments or discovery's, or Els Some Repugnancy to /y<sup>e</sup>\ knowne property of body argue y<sup>e</sup> Contrary, there is reason to Continue of this opinion.  
<flourish underline>

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<sup>323</sup> i.e., 'and so forth to infinity'

Then to Consider farther what variety's this  
 Impenetrable Essens called body is Capable of  
 besides being broken multifariously, by w<sup>ch</sup> the  
 distinction of Identity of parts Emergeth. is that  
 those part's may be disposed with Respect to  
 Each other, In any mode or fashion whatever  
 Consistent /with\ & Not Repugnant to the Nature of it.  
 All w<sup>ch</sup> possible variety is Reduced to this one  
 distance. ffor If you take one Single part, there  
 is a figure to be observed, w<sup>ch</sup> is Nothing but a  
 certein position or distance of the part's /of that part\ with  
 Respect to Each other. as If sphericall they are  
 uniformly distant from a center; If square from  
 one-Side & y<sup>e</sup> like. If you Suppose 2. parts /or bodys\ In  
 view, there is besides the habitude of the parts  
 of Each Respecting themselves /w<sup>ch</sup> is called figure\ there is an ha=  
 bitude of ~~each~~ of those body's to Each other  
 first In nearness, Exposed, or Retired /Regarding y<sup>e</sup> parts of [each?]\; and In  
 distance, more or less Regarding the whole.  
 And these habitudes by reason the mass of  
 body in y<sup>e</sup> world is as wee find, broken, may  
 chang or Continue, If y<sup>e</sup> latter they call it  
 Rest, If y<sup>e</sup> other, It is called Motion. If the parts  
 of one body chang position with Respecting y<sup>e</sup>  
 Other, keeping neerly y<sup>e</sup> Same distance of y<sup>e</sup>  
 whole, It is called turning, If y<sup>e</sup> distance of  
 y<sup>e</sup> whole chang, it is Called progression; & If  
 both,

chang, then the body Moves foreward and  
 turnes together. If you consider Instead of 2  
 Single body Respecting Each other, More body's  
 while Regard is to them all, there is a figure  
 or habitude Composed of the whole aggrega=  
 te. w<sup>ch</sup> may Chang as Each & Its parts Res=  
 pect Each other Infinite way's & In all modes  
 and degrees; onely this is to be observed, that  
 If all but one, or the Greater Number Keep  
 the figure, & the chang is on the part of a  
 few, the motion is ascribed to them, & not  
 to the others. w<sup>ch</sup> is from a p<sup>r</sup>judice Growne up  
 in us from y<sup>e</sup> use of /our\ Strength, by w<sup>ch</sup> wee find  
 Small things apt ~~of~~ to Move rather then Great,  
 & therefore wee call /ascribe rest to\ the Greater, & Motion to  
 the less, & this Not as they are truely but as  
 they seem. So y<sup>e</sup> Sun Appearing Small, &  
 y<sup>e</sup> Earth Great & heavy, wee argue the sun  
 Riseth, tho It is y<sup>e</sup> Earth moves & shews it.  
 In a ship [hauled?] up to her Anchor, the Cable  
 seem's to Come in, tho It is y<sup>e</sup> ship ~~grew~~ goes  
 upon that. And In a windmill turned, it  
 is y<sup>e</sup> post that to one within Seem's to turne  
 and Not the Mill. ffor In truth, It /is\ one & y<sup>e</sup>  
 same thing. /for,\ if one or other begin's y<sup>e</sup> chang  
 the appearance is y<sup>e</sup> Same, whatever is the  
 p<sup>r</sup>judice or opinion.

27..

Therefore when things Move, that is chang  
 their position as to Each other, In any Respect,  
 There is nothing of Reality of Essence subsisting  
 In nature more then when doe Not to Chang.  
 And all that can be Inferred is, that the Same  
 things vary their position, or doe Not so. What  
 is the Caus or ocasion of this chang happening  
 here or there is not materiall, to be Inquired.  
 It is Enough that Such Chang, is, or /is\ Not. And  
 then, let any one tell me, what there is in  
 a body seeming to Move /more\ then in one seeming  
 at Rest. This Notion, If wee can once Comand  
 it, free from vulgar p<sup>r</sup>judice, is the most satis=  
 factory Resolution of the variety's, & phenomena  
 of y<sup>e</sup> world, that Ever was yet broacht In Naturall  
 philosophy and It is tedious to Multiply words  
 about maintaining it, the thought is plaine,  
 & applycable to Every thing. therefore I leav it  
 to studious Reflection, ffor If men will Not digest  
 hints Into good & mature knowledg, Inculcation  
 will scarce mend y<sup>e</sup> matter. but a litle More /of that\ anon.

As our knowledg of comon thing's, whereby  
 wee know y<sup>e</sup> difference between the reality, & our  
 Ideas of them, is Compassed, with y<sup>e</sup> help of diffe=  
 rent observation's & memory Compared, is but  
 Experiment. So the variety's that are made  
 by

/by\ the translation, or reciprocall Mutations of position and distance, of bodys. are knowne & Receiv appellation's, from the Experiments or various observation's wee have of them. w<sup>ch</sup> produceth all mechanicall skill. And that is as deducible from Ideas of Quantity as any other knowledg is, w<sup>ch</sup> brings it among the sciences mathematicall, & p<sup>r</sup>tends to demonstration. ffor the degrees of chang In the Common figure composed by divers body's, are measured by space, whereof and of body our Idea is the Same. and as there is more & less in Reall, so it is also In Imaginary Quantity or Space. And as wee compare Quantity's at any one Instant, and find Equality or Inequality of substance, & y<sup>e</sup> degrees; So In severall Instants wee observe alterations, & the degrees. as if 2. body's touch in one Instant and In another, they are devided, & so on successively more in continuation of chang. and at the same Instant's If more then 2. or 3. devide from a fourth, & some have Gone more space the other's in Each Instant, wee say they have moved faster. Hence is the Idea [of?] time, w<sup>ch</sup> is Nothing but the Measures of these changes compared together.

It is strang to consider, what fast hold these notions of time and place, have in our Minds,  
so that

So that, malgree all our reason & Indeavours  
wee cannot shake it off; w<sup>ch</sup> gives me occasion  
to discours a litle of it. Our ~~pere~~

Our perception is so annext to body, that  
Nothing reacheth our minds, but thro, or by  
y<sup>e</sup> Interposition of it. Nihil In Intellectu, Quod  
Non prius in sensu.<sup>324</sup> Memory is y<sup>e</sup> Sence, as a  
picture is of y<sup>e</sup> life, the act's of Reason are litle  
Els, but the deposing of fantasmes & p<sup>r</sup>judices  
and reducing thing's to simple Ideas, such as  
the practise of Algebra shews. The Will and de=  
termination of y<sup>e</sup> mind, apt to be matcht a=  
long by the Cours of corporeall Emergency's,  
but is yet overruled, and forc't to Comply in  
a Superior manner, and therefore is called, as  
really it is, free. is the onely thing /in\ us that I  
can divide from body. for w<sup>ch</sup> reason, all mo=  
rality is In y<sup>e</sup> will. And vice or vertue ascribed  
onely to that. of w<sup>ch</sup> wee may be confirmed If wee  
doe but Consider that wee know our power  
Every moment of o<sup>r</sup> lives, & wee cannot deny  
it to o<sup>r</sup> Selves, without belying our owne Minds,  
and Whither wee can Reconcile it, to other  
apprehension's, or Not; It is all one, that is a  
truth in originall perception wee have of our  
Selves, that will not be Contradicted. but Setting  
this spark of free will aside all of us that I know  
is body, or workt & governed by body, as if it  
concernes

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<sup>324</sup> i.e., 'Nothing is in the mind that is not first in the senses', an Aristotelian maxime.



concernes us Infinite severall way's. therefore  
 It is No wonder that all our Ideas are of the  
 nature of body. w<sup>ch</sup> as it is Space, hath Included  
 all degrees of more and less; so that all wee  
 thinck must be attacht to y<sup>e</sup> formes of Space  
 or Quantity, and time, the changes it admitts.  
 No Man Can Say that, If it pleased God, by his  
 word to annihilate body, that space or time  
 Remaines; If they doe, they must affirme that  
 If It were added, to destroy space and time,  
 both should yet Remaine. for there is the Sume  
 argument for both, that is our Inability to ab=  
 stract those Ideas. Wee know No moment of  
 life, without sence of space & time, then wee  
 affirme, there is Nor can be any destruction of  
 them. but whatever becomes of us & y<sup>e</sup> World w<sup>ch</sup>  
 wee may suppose gone, wee cannot shake of  
 y<sup>e</sup> thought /but\, that here and there, afore & aft  
 Remaines; and tho wee dare not say it, yet  
 wee doe with y<sup>e</sup> Same force thinck it, Even in  
 Spight of omnipotens. as If the being or Not be=  
 ing of any thing, depended on our fancy, and  
 this is Not onely vain but Impious Making  
 space & time coeternall & coexistent with  
 God. I would ask what is room, or time, when  
 nothing Exists to Measure it? The Same p<sup>r</sup>=  
 judice must ans<sup>r</sup>, what wee conceiv it to be.  
 I returne, how doe you know it? they [saw?]  
 wee

31./.

wee cannot Imagin otherwise. I believ it, but  
 Is this logick? I must confess, were I to seek  
 fame and not truth, I would assert, as a great  
 Author hath done,<sup>325</sup> that there is absolute time  
 and space, not at all Relative to body. and  
 I beleev he will have more disciples, for who  
 can Imagin otherwise? But In this My Inquest  
 of truth, I must affirme what is most rationall  
 to Conclude; viz<sup>t</sup>. that there is No space, but  
 Relative to some body or other, Nor time in  
 the world, but Relative to y<sup>e</sup> changes of body  
 or Motion; and taking away body & motion  
 Space & time are No More.

It follows that So much of y<sup>e</sup> world as is Not /nor perceives by y<sup>e</sup> Means\  
 /of\ body hath No sence of time, and such beings  
 as wee are, tyed to body, & perceiv by y<sup>e</sup> Means  
 of it onely; as body and its modes are, so Must  
 be our perceptions. Then taking it here for  
 Granted, that the changes of body & y<sup>e</sup> Configura=  
 tions of divers parts & systemes of it, gives us our  
 perception, I In ferr that If there be any Moment  
 wherein a chang is Not in y<sup>e</sup> seat of sence, that  
 moment is no part of time. And If God Almighty  
 Should make all thing's Rest a year, & then  
 move againe, that year were lost in account  
 of time as [it?] None such had bin. for as to our  
 sence, No time, & No Chang, is all one. then  
 wee

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<sup>325</sup> i.e. Isaac Newton, in the *Principia*.

we Must observe, that the perpetuall occurs  
~~from the action~~ of things in y<sup>e</sup> world ~~that~~ makes  
a Succession of pulses or Strokes of one thing u=  
pon another, some greater & some less, In the  
Quantity of thing's, and Spaces of time. Such is  
our perception a Notice of pulses or Remar=  
kable alteration's of body. and these things  
cannot be all observed at once, but successively  
one after another, w<sup>ch</sup> gives the Idea of time.  
and as all are not of Equall circumstance,  
but some more Eclattant then others, so wee  
are attentive to Some, & let other's pass, with  
litle or No Notice. And often the pulses from Me=  
mory, shall have force to p<sup>r</sup>vail & be attended  
too rather then other's without us w<sup>ch</sup> is Called  
Not Minding. And there is No Sleep or Moment  
of life without attention to (that is perception  
of) one thing or other; But More of this When  
I speak of sleep & dreams. At p<sup>r</sup>esent let us lay  
aside these chimerick Notions of space & time  
absolute; and depend on Nothing but what wee  
have clear Idea's of Quantity Compared in  
all possible modes of it.

I have already Stated /discoursed\ y<sup>e</sup> Modes of /between\ body/'s\ ~~to are~~  
~~be variable~~, by Chang of position or distance,  
 that is ~~by divers sorts of~~ motion /variable & diversifyed\ ad Infinitum  
 without any restriction or Inhibition, but Such  
 as may proceed from the Impenetrable Nature  
 of body, w<sup>ch</sup> will not be Contradicted.

It follows then that these changes com=  
 pared together, may (& wee know doe) pro=  
 duce or occasion in us the Idea of time.  
 that is a transition of the Sence, whither ac=  
 tuall, or Memoriall, from one thing to another  
 successively, but Continued without any /sensible\ pe=  
 riods of distinction /that are sensible to us\. And hence Result the  
 Ideas Comparative, of before & after; swifter,  
 & slower; Now & then; Sooner & later & y<sup>e</sup>  
 like. But becaus we have Not In our Na=  
 tures any Standard of Comparison, wee take /ordinarily assume\  
 /some\ one /for space\ w<sup>ch</sup> ~~wee call a comon Measure~~ ad libitum<sup>326</sup>  
 as a yard, feet, Inches, &c. So for time, wee  
 select some Notable & constant periods,  
 as y<sup>e</sup> diurnall Revolution of y<sup>e</sup> Sun, or Earth,  
 and Subdivide it, into 24. hours, &c. And  
 thereby

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<sup>326</sup> i.e., 'at your pleasure, liberty'

2.

## Time

thereby Subject time to all y<sup>e</sup> Methods or  
 arts of Computation, as Quantity It Self.  
 And to Say truth; time, and Space are Coincidents.

In order to understand this most avers Con=  
 cept. let us suppose 2. body's /at some distance\ Moving tow=  
 ards a. 3<sup>d</sup>. ~~supp~~ Resting. It is Not Necessary  
 both Should touch together, for one May  
 touch, and y<sup>e</sup> other Not be half way over.  
 There is a sueC /single instance of\ succession of /divers\ thing's, one after  
 another; ~~this~~ /the like\ is Not /so\ sensible to us In all y<sup>e</sup> de=  
 grees of sucession, w<sup>ch</sup> (as Space is devisible),  
 are Infinite; but at Some points, or period's  
 it ~~is~~ /are\ Noticeable to us. So that our perception  
 is Not /as it Seems really\ Continued, ~~as the Nature of~~ /like\ space, and  
 consequently motion ~~is~~, but fasten's at times,  
 or Instants, when there is somewhat our  
 organ's can observe.

One whole life, or Idea of time, is Made up  
 of these distinct sensations of chang, or rather  
 the periods of it /such\ as are Most observable.  
 but ~~Such~~ /those\ being ~~So~~ very Numerous /& frequent\ In y<sup>e</sup> Mind,  
 Either Imediately from sence, or by memory  
 that

3.

## Time.

that our Sensitive organ's cannot /act so as to.\ wishing with them, the Idea turnes to that of a Confusion; And that is our Idea of time. I observed that objects of sence, doe not contein the Images w<sup>ch</sup> they caus In our mind, and Instanced In light Colours, and sounds. ffor the changeable, w<sup>ch</sup> ariseth from divers coloured part's, Intermixt, w<sup>ch</sup>, tho In themselves distinct, give to y<sup>e</sup> Sence an Idea of confusion Not Knowne In y<sup>e</sup> Nature of things. S<sup>e</sup> /In like manner\ a Continued Sound is from Repeated, but Indistinguishable pulses. So time is a Cours of successive Sensations, of Incredible Swiftnes, succeeding Each other. And It is to be observed that If wee apply our In= tention, to Some More Remarkable; as viewing a prospect y<sup>e</sup> /Eye\ passeth to, & fro; and In hearing musick the tune, or gross measures are obser= ved; but If wee discharg all attention, the Mind yet Is full of Successive Sensation's, Even from Me= mory, or the aetion /perpetuall\ agitation of y<sup>e</sup> More Spiritu= ous part's of y<sup>e</sup> body, near y<sup>e</sup> Seat of sence: And these Either from without, or within are per= petually going, tho o<sup>r</sup> Attention is Not upon them. when a Manufacturer works, his mind is upon, the passages of his subject;

A

4.

Time.

A chess player is wholly Intent on his Gam=  
 betts, and Stratagems; but yet /under them\ y<sup>e</sup> Cours of per=  
 petuall sensations are going on. w<sup>ch</sup> give him  
 an Idea of time, besides y<sup>e</sup> Matters In hand.  
 And this can Never be shak't off. I can liken  
 this Notion of the Minds fullness, and yet the  
 being Intent on Some /gross Item's of Sence\ onely; by to an Imbroy=  
 dery; where y<sup>e</sup> flowers are Enterteining, but  
 yet the /uniforme\ Ground is as Much wrought ~~as that is~~.  
 Attention, w<sup>ch</sup> is a Spontaneous act, (for y<sup>e</sup> Mind  
 ordinarily Can pass from one thing to another  
 ad libitum), is Not at all Necessary to our Sence  
 & Ideas. as wee determine y<sup>e</sup> Idea of a chan=  
 geable Colour, without attention to particulars.  
 the sound of a. 5<sup>th</sup>. in Musick, is agreable tho  
 wee attend Not to y<sup>e</sup> Component pulses, and their  
 proportion ~~of them~~; and thing's roll in y<sup>e</sup> Mind  
 without our guidance or Comand; And iff there  
 be Not Gross thing's, as Great light's, Such as  
 fireworks In y<sup>e</sup> dark, theatricall Sport's, or y<sup>e</sup> like,  
 to divert us; Somewhat Els, as observing y<sup>e</sup> wag=  
 ging of y<sup>e</sup> leav's of trees, doth it, If Not that, a  
 Rolling Reflection of past things In y<sup>e</sup> Memory,  
 and without that a Continuall flow of Some What  
 Engaging

Engaging y<sup>e</sup> Sences, tho Not Minded, So that Wee  
 have No Moment without Chang of Ideas,  
 Small or Great, Nay both together; con=  
 current. No wonder then If wee cannot shake  
 off or abstract y<sup>e</sup> Ideas of time, or beleev it can  
 be, however true it is, that seting body apart,  
 and its changes, time is Not. It is Remarkable  
 how Greater objects take up y<sup>e</sup> attention from  
 lesser; as In y<sup>e</sup> day, many sounds are Not heard  
 that are perceived In y<sup>e</sup> Evening or Silence of  
 the Night. So the Starr's are hid, when the Sun  
 shines; but Some light Shall be discerned,  
 in y<sup>e</sup> Most obscure dungeon. And If y<sup>e</sup> least objects  
 wee distinguish, or know /were removed\ other's would E=  
 merg & strike y<sup>e</sup> Mind, w<sup>ch</sup> Els would Never  
 appear; and so Even of those, & other's, as I  
 Guess, to Infinite. W<sup>ch</sup> I alledg here as some other  
 matter's also, tho out of place, to shew that  
 wee have not a Moment free from fresh sen=  
 sation's, w<sup>ch</sup> fill's or Minds with a Resulting  
 Idea as of a confusion, Rep<sup>r</sup>esenting to us that  
 protraction wee mean, when say time passeth.  
 But If it Could be so ordered that, wee had  
 hours minutes, Even day's, or years, without  
 any positive Sensation, that space to us would  
 be no time, more then is between Moment & Moment.

I know



## 6. Time.

I know I write here counter to the most outrageous of all prejudices, In maintaining that There is No absolute time, No More then /Absolute motion\ place or space. A cardinale virtuoso<sup>327</sup> of our age, affirms the Contrary; and In the case of Motion produceth an Experi<sup>m</sup>'t, w<sup>ch</sup> I mean to disprove of Notorious oscitancy. Who Can Endure to hear it say'd, that Time depends in body, and the locall Changes of it, w<sup>ch</sup> abstracted, No time is, Neither fore, Nor [afer?], sooner or later. Quicker or Slower, or the like in any words Men pleas to use? And farther that Spirits, w<sup>ch</sup> wee beleev to Exist unally'd to body, have No sence or thought of time or succession, priority or posteriority of things: This is an opinion Negative ffor I hope it is Not Expected one Should say how they thinck, It is Enough that they doe Not thinck thro body, as wee doe. And tho wee cannot Imagine how, yet wee may Conclude they are not affected with the Modes of body, of w<sup>ch</sup> time is a remarkable one, as wee are. I Should not be so Confident In this, If I had Not oracular authority of its truth, In passages Well known w<sup>ch</sup> I need Not cite, Nor care to doe it in a  
meer<sup>328</sup>

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<sup>327</sup> Newton; the reference to a catholic prelate is no doubt intended to offend.

<sup>328</sup> Although this essay does seem to be approaching a conclusion, it breaks off, incomplete at this point.

In philosophy, and so far as humane Sagacity can penetrate, determine all things with y<sup>e</sup> Greatest clearness, and thereby If possible, Erect a body or systeme of philosophy, as may be Incontestable, unless with Cap<sup>tious</sup> Impertinents, Such as Cavil Even at y<sup>e</sup> Comon principles of Geometry. Here will Returne two Question's. 1. If this will Not hurt Religion 2. If It be practicable to adjust any hipotesis of Nature, since wee can but Guess of the main lines of it. to w<sup>ch</sup> two thing's I apply.

1. As to Religion, If it were possible to trace the Causes of all thing's to a Comon Caus, w<sup>ch</sup> were Not God; such bad use might follow. but there is no stop of Inquiry but at the Almighty, whose power, is, & must be y<sup>e</sup> one comon & universall Caus of all thing's, and that Granted all the Series of Religious truth's, & Revelation comes downe to us again with all the force of reason to Imprint /them\ in our minds so as to /fasten them at\ Rest & be Inexpungnable in us. This Repose is Not to be compast by an Inquisitive spirit, without this process of running up with Inquiry, & from that Culmen, Returne with satisfaction never to be shaken. It is possible the Cours may Not Succeed alike with all men, ffor some may tire half way, others Mis<sup>take</sup> & argue wrong. Some with a pervers

[bias?]

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<sup>329</sup> We are thrown into a page 9 of what is clearly not the *same* essay (although it later takes up the previous discussion of time, in debating liberty vs. prescienc), but rather a 'cartesian' natural philosopher's critique of scepticism and atheism.

10.

[Biases?] Hunting after arguments to Maintain  
 a vicious p<sup>r</sup>judice, rather than to be Informed  
 clearly of truth's, may miss the happy conclu=  
 sion a sincere Intelligent person obtains. thence  
 wee Have Hobbs's, Socinian's, deist's, &c.  
 and were there no Heresies, in less Inquisitive  
 times? perhaps More. I am sure If there be a  
 mean's to obtain With the candid and Intel=  
 ligent part of Mankind, It ought Not to be  
 Slighted becaus Men pervers will abuse them.  
 And I would fain know, w<sup>ch</sup> way can be taken  
 to deal with Such /but\ by Shewing the full step's  
 in their process, where they fall short and where  
 they overshoot, where are fals, & where a=  
 buse reason. and y<sup>e</sup> like, w<sup>ch</sup> with Good Men p<sup>r</sup>=  
 vent's their deceiving, and as for ill, I fear  
 there will be Such take what Cours you Will.  
 As for Example Hobbs argues against Imma=  
 teriall Substances, as a Contradiction, & so  
 concludes ag<sup>t</sup> spirits. what is this but a logo=  
 machy. the abuse of words. as he understands  
 they are, and as wee understand them they are  
 Not a Contradiction. for he mean's by subs=  
 tance body, and that is hath No Extruded place,  
 and then the p<sup>r</sup>tence of Contradiction falls,  
 besides says Hobbs, wee have No Notice of  
 spirits

Spirits for all the pheneomena of the world are  
solved by body. Its decision, and Motions. I  
would ask an artist in logick, If this Concludes.  
I know None, therefore there is None. What a  
silly Consequence is it, from the Restraint of  
our perception to the emergences of body in  
motion to Inferr No other body /beings\ Exists? theyre  
may be /Othere beings\ Infinitely /various\ In Number, Qualifications  
& power, & yet not be /locally\ Extended, for ought /that\ wee  
can argue to Exclude them /But\, farther, ffor under  
this author's Name I would alledg all my  
notes /I Intend\ to this porpose. The world Cannot be  
Solved by matter and Motion. I Grant all  
that depends on the knowne & experimen=  
ted laws of motion, May from thence be Infer=  
red. but what Say wee to animall life and  
Generation? I may p<sup>r</sup>sume to affirme that the  
knowledg of spirits is as Much trusted to us, as  
those Grand secrets. Nay, tho o<sup>r</sup> flesh Grows Con=  
tinually, wee know Not how; there are Infinite  
vegetables under o<sup>r</sup> Noses, yet wee understand  
No one /not y<sup>e</sup> least\ of them. that there are Naturall Instru=  
ment's Employed, as heat, moisture, earth chan=  
nells & y<sup>e</sup> like, but still the principle of /the\ vege=  
tation is unknowne /and Inimitable\ the fancy of filtration, y<sup>e</sup>  
pressure of y<sup>e</sup> atmosphere, &c. all Come short.  
Much more are life & Generation's Secrets  
Even to us that feel & use them /and to say truth the ludibrium filosoforum<sup>330</sup>\ None of the  
canting

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<sup>330</sup> 'Playful/foolish philosophers', this likely refers to the Rosicrucians and their later followers, i.e., anyone practicing chemistry or alchemy c. 1700. 'Ludibrium' was a word used frequently by the author of the *Chymische Hochzeit Christiani Rosenkreutz Anno 1459* (*The Chemical Wedding of the Christian Rosenkreutz*, anonymous (Johan Valentin Andreae?), Strasbourg, 1616).

12.

Canting p<sup>r</sup>tenders y<sup>e</sup> Chimists, with all their  
boast of making Gold, Could Ever produce  
the most contemptible thing that Nature in  
a vegetative or Seminall way produceth.  
Not a Spire of Grass, a drop of milk, /a dram of\ [merda?]  
or ought Els. therefore what a variety, Nay  
treachery is it, from a p<sup>r</sup>tended chain of Na=  
turall causes, w<sup>ch</sup> failes In y<sup>e</sup> better half of  
y<sup>e</sup> way, to argue against a deity, and Ever=  
lasting providence, & Revelation? I may Grant  
that, as I Reject the argument Nescia, Ergo  
Non Est, on y<sup>e</sup> one side, they May /on y<sup>e</sup> other side p<sup>r</sup>tend to\ Returne,  
ag<sup>e</sup> / as If wee say\ credo, Ergo Est,<sup>331</sup> ~~on y<sup>e</sup> other~~. If the Credo  
did Not lean on actual Revelation, w<sup>ch</sup> y<sup>e</sup>  
Nescio Will Not p<sup>r</sup>tend too; And as to our Re=  
ceived Revelation's I will be positive, they  
have the Same certaintly to Require our  
assent, as any history, Nay the Information  
of our Immediate sence, or that wee are  
awake and Not asleep. If it be thought I  
Exaggerate here beyond y<sup>e</sup> p<sup>r</sup>tension's of a  
philosofer, that ought to Make More Mode=  
rate Comparison's, I can onely say, I write  
my sence, & perhaps when y<sup>e</sup> objector hath  
thought as much as I have done he will be  
of y<sup>e</sup> Same opinion. I may Mention another  
to pick, w<sup>ch</sup> anti spirituall men often argue  
from.

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<sup>331</sup> i.e., 'I do not know it, therefore it cannot be ... I believe it, therefore it is so'

from; w<sup>ch</sup> is that providence might act  
clear, direct, & /as wee fancy\ with Eas, ~~as wee fancy~~ /for\  
when wee ask one and other Questions /w<sup>ch</sup>\ Ex=  
pect categoricall answers, & Not by amba=  
ges. So a prince or generall signifies his  
will. In totidem verbis,<sup>332</sup> and Not by psalmes  
occasionally profesy's, Historical Relations,  
and Miracles /with them\ of dubious construction. and  
therefore say they all these are thing's  
caually framed and assumed ffor the se=  
ming authority's they bear to Influence  
Mankind. This is like y<sup>e</sup> other, Wee thinck  
y<sup>e</sup> other course more proper, and therefore  
providence Never could make use of this;  
first how doe wee know y<sup>e</sup> other cours More  
proper? are wee as y<sup>e</sup> deity, omniscient, or  
as popes p<sup>r</sup>tend Infallible? oh say they, then  
No men would be wicked, and Even wee  
Should, were wee directly Instructed by Im=  
mediate revelation to our selves, beleev.  
That is to Say a man In close prison, is  
temperate, and sedate; or one that hath  
No drink, Sober; or person's in bridewell  
very laborious. In Short /w<sup>ch</sup> is no less senceless\ that Men deser=  
ve, or demerit for thing's Not of Will  
but

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<sup>332</sup> i.e., 'in so many words'

14.

But Constraint, Such /Explicit\ Means of providence were a force, & left mothing to free will. and certainly discharged all the distincti= ons of good, Evill, merit, demerit vertue, vice, Reward & punishm't. ffor When Motives are too hard for the will, all these things fall to the Ground. as for Example, Suppose a man admitted to /a\ direct /personall\ Revelation of our Religion, and future Rewards and pu= nish-Ments ~~that~~ are held forth by it. Either he amended his faith & work's, or Not. If the latter, it Must be concluded he was Not compos mentis, or a free agent; ffor None Can be So Stupid to choos Misery, & Refuse felicity, clearly p<sup>r</sup>sented to him. If so, It would be Injust to lett the punishm't fall on him that was Not a free agent, ~~so~~ his and had Not power to determine; And on the other Side, It would carey No claim of reward that a man did well; thanck him ffor Nothing, he could Not otherwise choos. but when well doing is from the will, determined by the Judgem't, assisted with ~~those~~ /the\ Mean's of probability's allow'd ffor our Exercise, there it claimes the Reward; while striving against

A right understanding, & bending the will peversly ~~against it~~ /otherway's\, and all from devious appetites of thing's Not onely forbidden, but really /Irrationall & Mischevous In themselves, can never claime other then sinister recompence. The Sume of this is, Wee know Not what Cours of providence is best, & Indeed, how Should wee? If wee did, & the Effect of generall assent & Reformation followed, It were plainely to No End. becaus it takes away good, & Evil; & is No less then a Coersion, & Not Instruction. besides the devinity Needs us Not, & is Not better or wors for our Religion, or perversness, It is Comitted to as for our owne sakes, ~~and cannot~~ /w<sup>ch</sup> could Not\ be ~~so used~~, but by Referring it to our Will Guided by our understanding; and If the latter be Supplied the other ought to conforme. Why doe they talk of p<sup>r</sup>science being a p<sup>r</sup>determination. I challenge ye disputer If he doth Not feel his will to be free, as Much as he feels (If I may so terme the clearest Conviction) 2. & 2. to Make. 4. or any Comon axiom. If he Say's, Not, I know /then\ what to thinck of him; If he say's, yes; then why doth he dispute, against his sences. and as for  
the



16.

the puzzles then /Ignorance\ Makes about p<sup>s</sup>science /y<sup>e</sup> matter, I demand\; What  
 is ~~that~~ /p<sup>s</sup>science\ where is No time? fore or after: they  
 say the Cannot understand /that\, but /[.?.?]\ all  
 thing's ~~that~~ /w<sup>ch</sup>\ Exist & thinck must be Sen=  
 sible of time. ~~It may be So, yet It is Not~~ /How know wee that. why must time,\  
 Necessary ~~that time is~~ /the register of divers Movement's be\ Necessarily affixt to  
 the mode of perception In all Imateriall  
 beings. /Oh,\ becaus wee (that know Nothing  
 but from body, & the division & Motion of  
 it) ~~w<sup>ch</sup> is time,~~ cannot tell how /it should be otherwise, Remember\ Before  
 Abraham was I am;- and doth Not the  
 Righter Sence of filosofers Even Now Ex=  
 clude time from all Imateriall beings/?\ yet  
~~an ordinary~~ /I must Grant ffew\ person/'s if any\ Will Not be Convinct /of it\  
 /So Strong is p<sup>r</sup>judice\ but what of that? Must the ~~deaty~~ /Almighty\ & Nature  
~~w<sup>ch</sup> are the~~ /his\ ordinances of it, be Confined to  
 our Experience or Capacity, to determine  
 of them, Whither, What, or how.? It is Strang  
 that Men p<sup>r</sup>tending to Reason, Should argue  
 So Shallow, as to determine of the Existence  
 of thing's, from their shortsighted prospect. as  
 If a traveller Should Conclude, y<sup>e</sup> End of the  
 World was the top of Next hill, becaus he  
 Saw No farther. And I am Sure take away  
 this Argument from them /vist. I know Not how it can be therefore it is Not\ there is Not an  
 umbrage Remaines ag<sup>t</sup> providence & Re=  
 velation w<sup>ch</sup> a person of Sence would hold  
 up

up, & Not blush; Then they Say Contradiction's cannot Consist, but If one be true y<sup>e</sup> other must be fals. true, stated in plain and Intelligible termes, as Est, & Non Est.<sup>333</sup> But Shew Me Such a Contradiction In all the whole doctrine of Religion & providence. It is Easy with M<sup>r</sup>. Hobbs to Make Contradictions when he will forg words with a fals Meaning. How is liberty and p<sup>r</sup>science a Contradiction, when time is away. Wee Must throly understand y<sup>e</sup> Case before wee give Judgm<sup>t</sup> of /that\ Spirituall being's ~~to be~~ /Involve\ Contradiction, or that a Nullity of time is So. but it is [Sawly?] to determine /positively otherwise onely\ So, because Wee Cannot understand y<sup>e</sup> Matter. /profest\ Ignorance is a base mimick of Consumate knowledg; and it is a wors principle to found a opposition to Religion upon; /But while\ there is no ~~other~~, ~~So~~ /better\ that must doe y<sup>e</sup> work or Nothing. one would thinck, that while there is Such a Manifest Incapacity In humane faculty's to determine, the Consent of Nations & ages, the dangers of Erring, the benefit of order & vertue in y<sup>e</sup> World, If Not Getting the better of doubdts, Should Confirme their practise In the way of Submission, as if [Conduct?].

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<sup>333</sup> i.e., 'It Is and It Is Not'

18.

All w<sup>ch</sup> considerations May confirme this frequent censure of such men, w<sup>ch</sup> is that unless their will's were corrupt & bent to practises Inconsistent with their owne & y<sup>e</sup> publick good, ~~but~~ selfish, vitious /lustfull\ ravenous and Injust, they Never would Straine their faculty's to Conclude so peremptory as Many /doe\ agt Religion. & providence, When all they say amounts to No More but Either ~~profest~~ /declared\ Ignorance, or vaine derision. I have Not debated this matter as designing to Insult a confutation, w<sup>ch</sup> hath bin and dayly Is the Subject of transcendent pen's, who /have\ [left?] No ~~corner? or~~ subterfuge [~~unferretted?~~] In the controversie (If I may Comply with Ignorance In terming it so) /unexposed\ but to Shew that the Moderate philosophy, w<sup>ch</sup> Requires the clearest principles, and closest argument's, Even up to a geometrick rigor, if possible; is the Most Efficacious way of overturning atheistical confidence. Whereby I may, with others, that are convinc't of the Corpuscular hypothesis of Nature, /may not fall under the ~~be absolved ffrom Such /those\ Imputation's as Ecclesiasticks have suspected /of\ us for and often Insults under y<sup>e</sup> of Ecclesiasticks,~~ /of our academick writers\ upon any Such account, knowing them Most apt to fall rudely on all they call Cartesians.

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Cartes.

1. There are works of D. Cartes of 3. Sorts  
 1. Metaphisicks, 2. Geometry, 3. philosophy  
 or phisicks.

I shall postpone ye 2. former, and Reflect  
 at p<sup>r</sup>sent on ye latter, his filosofy onely.  
 And as to that.

1. His Method. w<sup>ch</sup> is reducible to this Rule  
 of thincking, /vist\ to lay by all matters of w<sup>ch</sup> any  
 doubdt is conceivable. and then, searching for  
 what is most clear to [us?], build upon that  
 in like process, as In Mathematicks, proceeding  
 by stepps, from ye Most clear /& distinct\ to other More  
 Intricate matters, as they are clearly deducible  
 from them. from thence he determines the truth  
 of his owne Essence, his thincking faculty. Hu=  
 mane defects, & thence the Notion of a better  
 being, God. w<sup>ch</sup> last he calls an Innat Idea,  
 but give it what Name you pleas, the thing  
 is the Same, vist. Mankind is sensible of Want,  
 Ergo, he is sensible of a better being, or one  
 w<sup>ch</sup> doth Not want, as he himself Would be  
 If he found Such perfection in himself, as  
 to want Nothing. Now that this Notion is Inci=  
 dent to Humane Nature, and grow's up into  
 strength & action, as a Man grow's in body  
 and

and y<sup>e</sup> use of thincking, is Most certein. Why then May it Not becalled, Innate? o Say's M<sup>r</sup> lock in an Elaborate chapter,<sup>334</sup> Men have No Idea's att all, but from Sence, & then Secondarily Reflection, therefore this Idea of a God is Not Innate, but proceeds from Reflection Grounded on the sensation of things occurring /y<sup>e</sup> [...?]\ in his life. true, but If it proceeds from a certein Reflection that Must be made upon the Sence he hath of his owne constitution, or fabrick, and wtever objects he Meets with More, or fewer this or that sort, It is all one, his owne body with it's Needs and occasion's cannot fail to draw his attention & consideration; W<sup>ch</sup> is E=quivalent to the being Inseparable to y<sup>e</sup> Nature of man. Where is there y<sup>e</sup> fault of calling that w<sup>ch</sup> No Man ~~hath~~ is without, Innate. I grant that Infant's doe Not philosophize; and that strength of body is Required to Enable action's of y<sup>e</sup> Mind, & y<sup>e</sup> latter doe Not come to full strength & vigor but with Maturity of body. And that our Reflections doe Not settle In any /good & sure\, Method, Early in our lives. but by time, practise & use of thincking, so as to digest them for the Conception of others to whom they may be communicated. therefore If this Notion of a god, without w<sup>ch</sup> wee say  
our Nature

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<sup>334</sup> John Locke, *An Essay Concerning Humane Understanding*, London, 1689/90.

our Nature doth Not Subsist Were to be  
 the Result onely of a filosofick arguing  
 mind, It Might be Say'd, It is Not Innate, but  
 acquired as other knowledg of art's, is by late  
 Experience of things. But this is with y<sup>e</sup> first  
 Instances of life. are Not the beginnings of it  
 Complaints, signified by y<sup>e</sup> passion of Crying?  
 Then want or pain subsists Not without  
 a notion of freedom from it, y<sup>t</sup> is a better State,  
 and consequently [as?] somewhat that is free  
 or May Make us free from y<sup>e</sup> like, w<sup>ch</sup> after  
 wee came to Consider well, must be admitted  
 to be that wee call, God. and is So far Innate  
 as /to\ follow from that w<sup>ch</sup> No Nature is without  
 want & pain.

But Say they, Cartesius Say's this Notion  
 could Not be made in us by chance, but Must  
 be Imprest. that is when the Constitution of  
 our part's is such, that wee must from thence  
 have Such ~~Not~~ Notion, I thinck it is Imprest  
 in us.

from all w<sup>ch</sup> I conclude that In this point  
 w<sup>ch</sup> Cartesius thought a demonstration of  
 a deity from naturall light, and So Much  
 battelled by Mr. lock In English & other's  
 anticartesian's, before him. they have all  
 fought with words, & Not thing's.



As to the Rest of Cartesius Method, I touchd be=  
for, I know Nothing In the way of knowledg  
Ever [---?] p<sup>r</sup>vailed So Much, as that hath done; it  
is Now the first chapter in all book's of arts,  
and Ever p<sup>r</sup>viously declared, that what wee  
conceiv clearly & distinctly to be true; Such  
as y<sup>e</sup> axiom's of Mathematitian's, are s<sup>e</sup> and  
the like of theorem's y<sup>t</sup> as clearly & distinctly  
are Shewed to flow from them. And Where Els  
can any knowledg begin but upon clear  
and distict principles; /y<sup>e</sup>\ very authority of all  
tradition, is Made good by argument's drawne from  
Such. let any one look into Newton, Lock Keir<sup>335</sup>  
and all those who Glory in Insulting Cartesius  
& it

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<sup>335</sup> Could RN be referring to John Keill (see f. 179r, above)?

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A Body centred on  
a. pin.<sup>336</sup>

Every Impuls is Either Extreame, or Mean.  
The Extreames are. 1. When y<sup>e</sup> force falls upon  
A diameter Indifferent, by w<sup>ch</sup> No turning  
succeeds, but all the force of the stroke beats  
upon the pin, & draws the fulciment. as let  
<diagram> A. C. B. be a body Irregular. and  
the Impuls at D. the Indifferent  
diameter. D. F. so as the parts  
that draw from y<sup>e</sup> Contact, vis<sup>t</sup>.  
towards G. & towards H. have  
Equall strength. then Neither shall Move.  
but y<sup>e</sup> Stop of all y<sup>e</sup> force, ly upon y<sup>e</sup> pin. C.

2. When y<sup>e</sup> force falls, on the Extremitie of any  
diameter, as at. A. when all the part's draw  
from y<sup>e</sup> Contact one way, So that No thrust at  
all, or Inconsiderable, falls upon the pin. In  
w<sup>ch</sup> case the body Moves, ~~Even~~ /turning onely\ as If it were  
not centered but free. W<sup>ch</sup> Cases are plaine  
from y<sup>e</sup> foregoing.

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<sup>336</sup> At the moment I am reading this as a reflection on leverage as turning power (torque). The key points are (1) that the force must be directed through the pin (as a fulcrum) otherwise it falls upon the pin (which can happen either way in irregular turning forms); and (2) the greater the leverage the more possible the turning.

But y<sup>e</sup> Mean's /betwixt both\ when, Some part's draw  
 from y<sup>e</sup> Contact ~~Inclining to turne one way,~~ /towards y<sup>e</sup> pin and other's Inclining\  
 & some y<sup>e</sup> other, ~~but unequally,~~ so as the /to turne, at A. K.\  
~~p<sup>r</sup>evailing Carry it, according to the difference.~~  
 <diagram> Draw the Extreame diameters, 1.  
 that of No turning, D.F. 2. that  
 of all turning A.B.

I say as the ~~motion of the part~~  
 struck ~~is lessened,~~ Moves slower  
 from the Contact, the less force y<sup>e</sup>  
 movent hath to Move turne the body. W<sup>ch</sup>  
 In plain by y<sup>e</sup> Extreames. as one at. D. when  
 y<sup>e</sup> body cannot Move from y<sup>e</sup> Stroke at all, there  
 is No turning but at. A. Where it may with  
 y<sup>e</sup> same celerity as y<sup>e</sup> Movent hath, it is all  
 & full turning. but at a Mean, K. observe,

The tendency if y<sup>e</sup> point Struck is towards  
 C. but It can Move onely In the Arch. K <wavey line>  
 w<sup>ch</sup> Recedes

It may be worth consideration to distinguish, as far as we may, the texture of diaphanous & opac bodys. Glass is, of y<sup>e</sup> former sort the Most Comon; and It is most visible that it is very porous, and rough, Els ~~hould~~ how Could Great fly's so Easily climb by it /y<sup>e</sup>\ Superficies of it. their claws are pointed, but Not so fine as many thing's w<sup>ch</sup> fall under y<sup>e</sup> observation of y<sup>e</sup> Microscope; Nor is their small weight any Circumstance, for by Means of their hold upon Glass, they will draw hard, to Escape a spider & his webb, y<sup>t</sup> partly Intangles them. Therefore y<sup>e</sup> pores of Glass are Gross with Respect to those of many other body's. Quere<sup>338</sup> If fly's will sit so lightly upon polish't Mettalls silver or steel, I Guess Not, but have Not y<sup>e</sup> proof.

It is Certain that light, tho In y<sup>e</sup> Main passing by Strait lines, yet Shall deviate & spread, a certain Consequence of Irregularity In y<sup>e</sup> passages thro y<sup>e</sup> body it passeth. As If light Enters at a square or triangular hole In a church windoe, by that time It gaine y<sup>e</sup> wall, y<sup>e</sup> Mark of it, Shall be ovall or squ or circular, & never angular as y<sup>e</sup> hole is.

It is also a property of light, from y<sup>e</sup> Same Reason to gaine upon darke. by w<sup>ch</sup> mean's a Reticular passage at some distance is lost, as to all discernement. ffor If you look at y<sup>e</sup> Sun thro a Jelousia at good distance, the light Shall Not be so Strong as open,

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<sup>337</sup> This a short, two-side refelction on glass as a surface, and then on 'pellucid' surfaces generally.

<sup>338</sup> i.e., Query, question.

as open it would be, but No lacunes or Shade will  
 fall on its body distinguishable from the lettice: f[or?]  
 this Reason, the lustrous part of y<sup>e</sup> Moons Globe, [...?]  
 y<sup>e</sup> Novilune, shall seem a portion of a larger sph[ere?]  
 then the dark part.

And as to the Reflection So lively from the surfa[ce?]  
 of pellucid bodys, there is a great faintness to b[e?]  
 observed more then from Mettall, as the foyle of [...?]  
 lookingglass or polish't stel. I account the /surface of a\ pelluc[id?]  
 body to be as a Jest~~t~~ Jelousia or lettis, w<sup>ch</sup> ke[eps?]  
 out but litle light, and that w<sup>ch</sup> is kept out is  
 Reflected. and If our sence were Subtile Enough, &  
 Neer, Might discerne to be Reticulate as the bod[y?]  
 that Reflects. but admitting that at a certein  
 neerness as 1/2 Inch, or such small space, wee Might  
 discerne it, yet at comon distances, y<sup>e</sup> Spreading  
 of y<sup>e</sup> light would Make it seem Continued. Whither  
 the surface consist of lines or points or of what form[es?]  
 soever, y<sup>e</sup> Reflection is Much y<sup>e</sup> Same; for polishing  
 is but Reducing the protuberances to fall in the  
 same plane. As to Instance in Regularity, Globes  
 upon a table, w<sup>ch</sup> all send onely a single speck  
 of light from Each, at distance would seem as  
 a surface of a transparent body, whereof the  
 Reflected light, must be taken at a certein  
 place. tho there is a difference, for y<sup>e</sup> Roundnes  
 sends a speck Every way, but a litle flatted at y<sup>e</sup>  
 topp, all in y<sup>e</sup> same plane, answers my Intention.

<flourish underline>

the stroke, at y<sup>e</sup> very Instant, before y<sup>e</sup> Circulatory wave arrives. this action adumbrates to us the nature of light. ffor If a luminous body Beats y<sup>e</sup> fluid with ~~sufficient~~ /a<sup>t</sup>\ force /& y<sup>e</sup> force is sufficient\ or, (W<sup>ch</sup> is all one,) our op=  
 ticks are Nice Enough, wee must perceiv it, In y<sup>e</sup> Same Manner as y<sup>e</sup> animall perceivs that stroke.  
 onely Note, that what a creature perceivs by his body at larg, is touch; but what is perceived by y<sup>e</sup> Eye, is light. and altho No other then Meer touch, It hath a singular carактер, & is distinguished as if it had a Nature more sublime. /And\ for No other rea=  
 son but becaus, It is /most tender & such Influences are\ sensible in that one part onely and there So Neer y<sup>e</sup> seat of y<sup>e</sup> Sence, it hath a life & Spirit Incomparable, and Makes us admire, it as a wonderfull glory In the object, while all y<sup>e</sup> lustre is in the perception, and /really\ Nothing in y<sup>e</sup> object but the occasion. as a stroke with a battoon, Gives a paine, w<sup>ch</sup> is in y<sup>e</sup> Creature & Not in y<sup>e</sup> battoon, ~~W<sup>ch</sup> Was~~  
~~but~~ y<sup>e</sup> dull occasion of it.

for clearer Exposition of this action, and to shew the reality of it, let us consider water in a cis=  
 terne, & that perforated in divers places, at w<sup>ch</sup> the water Issues parabolatim. let the surface of y<sup>e</sup> water be lustily struck, and y<sup>e</sup> Effect shall be seen at y<sup>e</sup> vent, by the parabola of falling water star=  
 ting forth. and the like will befall at Every vent that is made. these vent's are as y<sup>e</sup> visuall organ

w<sup>ch</sup>

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<sup>339</sup> Again an abrupt entry into an essay, here on the 11th page.



12.

W<sup>ch</sup>, with its tenderness, is Imprest by an Influence from y<sup>e</sup> Stroke; And as In all percussion of body the part's are protruded by a Right lined Influence from y<sup>e</sup> point of contact, so y<sup>e</sup> water is In like manner driven; and the Influence from y<sup>e</sup> Stroke passeth as light thro y<sup>e</sup> whole to y<sup>e</sup> vent's, as to Every other part, but there being a cession of y<sup>e</sup> Matter, it is peceived, and Not where there is Not some ac= tuall cession. And one may Imagin, upon such Stroke, a radiation of y<sup>e</sup> Influence from y<sup>e</sup> place of y<sup>e</sup> touch, to all part's of y<sup>e</sup> ambient vessell. w<sup>ch</sup> In the case of light are called ray's, And In this Shade of it In y<sup>e</sup> forme of water, I may use y<sup>e</sup> Same terme, ~~but~~ Meaning Not any corporeall Ema= nations from the body that strikes, as In the case of light are /vainley\ supposed to pass thro & thro y<sup>e</sup> Medium but onely /that so is\ the shortest direction of y<sup>e</sup> force, thro a perpetuall Continuity of y<sup>e</sup> parts.

As here wee have Supposed one single stroke u= pon y<sup>e</sup> Surface of the water, let it be struck In divers places at y<sup>e</sup> Same Instant of time; It cannot be de= nyed but Every stroke hath a distinct Influence, on all y<sup>e</sup> sides of y<sup>e</sup> vessel, and particularly y<sup>e</sup> vent's or Eyes, and (If I may So Speaks) send ray's every way & y<sup>e</sup> Ray's of Each cross Each other, without Interrup= tion or confusion. And If a single stroke be by one broad surface of a body on y<sup>e</sup> surface of y<sup>e</sup> water, there are Ray's Every way from Every part of that surface.

## 13.

Surface, w<sup>ch</sup> Ray's Cross each other, without con= fusion or disturbance. this cannot be doubtded, ffor the Influence of y<sup>e</sup> Whole Stroke, is Compound of all y<sup>e</sup> parts, and If any part were away, y<sup>e</sup> Influe= ence were less; therefore being p<sup>r</sup>sent, hath like Effect, in proportion, as y<sup>e</sup> other parts have. And by wherever it falls, is formed; as In vision Every object hath a Magnitude, reall, & apparent; the latter being formed ~~from~~ /by\ the Ray's verging from all y<sup>e</sup> part's of y<sup>e</sup> former, according as they are directed. And that May be to Magnifie or demi= nish, by mean's I am about to propose.

## 3.

Having layd this foundation, I cannot but carry on y<sup>e</sup> paralell of y<sup>e</sup> vessell of water, to Shew that Reflection, and Refraction, y<sup>e</sup> Wonderfull phainomena, of light, are No less Exposed by it then the direct Ray's. lett. A.B.  
~~<diagram, crossed out>~~ be y<sup>e</sup> Surface of water ~~<diagram>~~ struck in, H. the strait Influence or Ray's pass to all parts, as to. E.  
 let an hollow vessell be Immerts & fixt as ~~E~~ F. with a foramen, Garded ag<sup>t</sup> the Comon pres= sure of y<sup>e</sup> water, but yeilding to a stroke at H. added. Then upon Such stroke the water shall be forc't in at. F. This cannot be by a direct Influence, from H  
 becaus

14.

becaus that cannot touch y<sup>e</sup> foramen, then it Must  
 be from Repercussion, or Reflection from some part  
 of the vessell; If it be asked from what part, I ans<sup>r</sup>  
 that from Whence a body would Move, If this radiated  
 Influence were converted, Into ~~actuall~~ /progressive Regular\ movement  
 And that by y<sup>e</sup> Rule of Reflection must be from. E. And  
 It is Most reasonable to Conclude, that y<sup>e</sup> prototype  
 of this Experiment, light it Self, acting so Constant=  
 ly according to that Rule, Whereon is founded all  
 catoptick skill, should derive it from the simple  
 disposition of particular body's, w<sup>ch</sup> in Regular Cases  
 is found and demonstrated to be Such. And If it be  
 objected that fluids are Not Composed of Regular parts,  
 and Irregulars are Not tyed to that Rule. I ans<sup>r</sup>, whither  
 they are so, or Not, makes no alteration; ffor If Ir=  
 regular, the Mixture is uniforme, & then what on one  
 part divert's another set's right, and a Mean of  
 all the deviation's mark's out y<sup>e</sup> same ruler as, what=  
 Ever one shall say to argue the deviation to any  
 other point assigned, I will say to argue it as Much  
 y<sup>e</sup> other way, w<sup>ch</sup> In consequence set's up y<sup>e</sup> rule a=  
 gaine, vis<sup>t</sup>. that the ang of Reflection is Equall to y<sup>e</sup>  
 ang. of Incidence. I must Note here as often When  
 occasion is given, that these Reflected Influences, or  
 Ray's, come & pass to & from all parts, crossing y<sup>e</sup>  
 direct & one & other, In a Manner w<sup>ch</sup> Specula=  
 tion carry's to Infinite, without confusion, or Impedi=  
 ment, Exactly according to the phenomena of  
 light from a candle in a room, such as cannot  
 be

taken from Cartesius, viz<sup>t</sup> the laws of Motion  
w<sup>ch</sup> he states very nice short & exact, yet  
his whole aime & designe is to Cross des Cartes  
philosofy, and to set up Quality's, w<sup>ch</sup> he threw  
downe. and ~~this he doth~~ In the very Method  
/he proposes is that\ W<sup>ch</sup> Cartes Recommended to ye world. to admitt  
nothing In /a\ phisicks/all Hypotheses\ w<sup>ch</sup> had Not a Mathema=  
ticall clearness, Except In particulars w<sup>ch</sup>  
must be held to Experiment.

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<sup>340</sup> Another fragment, in which we can readily identify the character under analysis, as well as recognising the argument from the similarly titled essay, above ...

277v

<page blank>

Mr. Keil.<sup>341</sup>

Argues Reflection from [Electer?], & Not Reaction  
ag<sup>t</sup> Cartes, with frivolous discours. as.

that. (followin)g . . . . (going)<sup>342</sup> tho ~~less~~ No direction  
is contrary, Reflects. tho as cartes say's Motion to  
Motion is Not contrary but direction to direction  
(w<sup>ch</sup> Sentence is after y<sup>e</sup> old logick, & Not ad rem<sup>343</sup>)  
then say's he if y<sup>e</sup> Motion be Not contrary, it is  
Much Easier to reflect then to Stop Motion.

that on all Impulses, Reflection Must follow, if  
Nothing were Contrary to Motion. but In lead  
[wod?] [---?] &c., Would Reflect.

That hard Reflecting body's, are Elastick, by  
sound, as bell.

That hard Globe toucht with [Into?], & struck with  
another is colour'd with a ~~sup~~ breadth, ergo, the  
superficies is comprest; & Ends with a Q. E. d.<sup>344</sup>  
Not considering y<sup>e</sup> body of y<sup>e</sup> Colour is [pres't?] & Not  
the Globe.

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<sup>341</sup> see note on f. 179r. I have yet to establish to what these notes refer, possibly Keil's  
'Introduction to Natural Philosophy'?

<sup>342</sup> The words/part words 'followin' and 'going' are encircled, here represented by bracketing.

<sup>343</sup> i.e., 'relevant, pertinent'; or 'addressed to things' rather than quibbling with words.

<sup>344</sup> QED = Quod Erat Demonstrandum, i.e., that which is to be demonstrated, the conventional  
conclusion of a mathematical proof.

<diagram> Body B.D. striking. C. in  
A. directs it to E.

Body c. from E. striking  
B.D. in A. (infinite great)  
shall Reflect back to E.

The direction A.E. is less  
opposed by y<sup>e</sup> ang. C.A.E.  
afore the stroke. therefore y<sup>e</sup>  
Effect, after shall be accor=  
dingly. vis<sup>t</sup> . p<sup>t</sup> ≥. E.A.F.

Againe. it is harder to Reflect C. from A. to E.  
then to any ang. versus D.  
~~for~~ And C. Struck in A. (Resting) with Infinite  
force can give but y<sup>e</sup> direction, C.E.

The Effect of an Infinite force from C. is Not=  
withstanding y<sup>e</sup> obstacle A. to goe on in c. H.  
the force of C. quoad<sup>345</sup> direction abates by y<sup>e</sup>  
Inclination. therefore the force Reflecting  
(Infinite). Must quoad direction abate of  
the Effect; and let the former direction p<sup>r</sup>vaile  
Intanto.<sup>346</sup>

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<sup>345</sup> i.e., 'with respect to' (a legal latin term).

<sup>346</sup> presumably = 'in tanto', i.e., 'in the meanwhile' (Italian)

## audible

The Case of audibles differs much, ffor Sounds Can be Compared onely with /by\ help of Memory, ffor /if\ a /Single\ Stroke upon y<sup>e</sup> Sence is Gone can Scarce att all, it is {well?} /may can be Remembered, And No More\, but

When y<sup>e</sup> Sound /continues that is y<sup>e</sup> strokes are\ is Repeated, then Not onely y<sup>e</sup> Strokes but y<sup>e</sup> time or Intervalls of them are also Remembred and by comparing/ed\ times afor & after wee Judg of y<sup>e</sup> Circumstances as well as things The Idea or Image of time /Regular & Periodicall time\ May be Conveyed to our Minds by any sensible movement or touch, but Is Most Emi= nently & Constantly Conveyed /to us\ by /means of\ Sounds, and from thence moves /wee derive\ all y<sup>e</sup> beauty wonderfull Effect's of Musick as /Harmony\ /w<sup>ch</sup> I\ May /make\ appear /more fully\ afterwards, When I may shew it is In truth /coming to demonstrate that Musick is nothing but /a Regu\ Comparison or, /regular\ Mixture, of /& comparison\ of temporary periods. /A touch upon y<sup>e</sup> organ of hearing May be Called a Sound the Continuance or Repetion of it a tone\

~~It may be Inquired whence it proceeds, that Sounds seem Indistinct, and affect~~

~~When /if\ regular In Equall time Musicall, and If Irregular, /A\ Nois. So words are found to distinguish our Con= ception's. and by y<sup>e</sup> word Sound all may be understood according to y<sup>e</sup> Subject Matter; then so If sound May Con= sist of pulses distinguishable or Not y<sup>e</sup> former is best knowne by beat of drum, y<sup>e</sup> other In the tones of Musicall Instruments, or squeeeking of wheels, & such like mean's of Nois. the limits of distinction, is y<sup>e</sup> power of Moving our body's. ffor If y<sup>e</sup> Strokes are so fast that wee Cannot accompany with any part of our body, as Nodding, or Moving y<sup>e</sup> hand &c, wee give up y<sup>e</sup> acc<sup>o</sup> & it Seem's continued.~~

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<sup>347</sup> On this one sheet there are two seperate openings of essays, on this side 'audibles', overleaf 'Attention'.



matter, devided so the Will life, Intervalls  
Sense Sleep.<sup>348</sup>

Attention.

The Main Ingredient off attention, is time, that is Motion; and all our Movement's doe certainly depend on the frame & composure of our body's. /[-...?]\ When wee see any thing, wee have power to hold y<sup>e</sup> organ in a posture of continuance; and then, the object affecting y<sup>e</sup> organ in y<sup>e</sup> Same manner, during all y<sup>e</sup> time passing, y<sup>e</sup> Mind Judges, by Comparing y<sup>e</sup> times afore and after. and If y<sup>e</sup> object vary's during y<sup>e</sup> attention then y<sup>e</sup> same times distinguisheth, & y<sup>e</sup> Mind argues it is not as it was. so, to proceed, In y<sup>e</sup> Same object y<sup>e</sup> Mind subdevides, & attends at one time, to one part, and after to another, & by Comparing them judgeth if y<sup>e</sup> Same or divers. And so farr as the Ma= parts are Not Confused by y<sup>e</sup> Medium or organ, the mind will be Employed, creeping along ffrom greater to Smaller part's, w<sup>ch</sup> by dissimilitudes discover them= selves, and at ffirst were not observed. And all this while there is a Corporeall action of y<sup>e</sup> part's of our body's, as y<sup>e</sup> Same are by Necessity Concerned, and the Minde act's Quick or slow accordingly. Some person's Need much longer time to observe then others, & some are so dull, Never to Collate thing's & observe differences as others doe. And In visibles, there is an advantage by y<sup>e</sup> continuance of y<sup>e</sup> object In y<sup>e</sup> Same manner, for that y<sup>e</sup> mind Can take time, & mean's to pass all y<sup>e</sup> parts & compare them.

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<sup>348</sup> These words, in small script, as we find elsewhere in the MSS (either at the head of the page, or in the margin), are presumably intended to act as an aide memoire during writing, although in this case, if they apply to this essay, they indicate topics not developed here (although, see the essay 'On Attention').

~~In astronomy, It is not proved at all, but onely /that force tho it comands all y<sup>e</sup> planets in our systeme\ observed, as when it is found that the Earth /is barely to be observed in one Effect pointing to\ and all y<sup>e</sup> planetts, whither Revolving or Not /y<sup>e</sup> North\ Shew y<sup>e</sup> Same face to y<sup>e</sup> North, and y<sup>e</sup> Ansa<sup>e</sup> or Annulus of Saturne, is neer y<sup>e</sup> plan of y<sup>e</sup> Ecliptick wee have No proof any vis doing this by /but onely that it is done\ astronomy but from y<sup>e</sup> Earth wee Inhabit, and /by handling y<sup>e</sup>\ y<sup>e</sup> Stone & Iron Wee handle, /obnoxious to y<sup>e</sup> Same force\ wee understand a little /somewhat\ more and from thence May argue a Comon Caus, W<sup>e</sup>Ever it //tho\ but Not Enough yet to explaine it but wee hope for\ is Governes y<sup>e</sup> whole. /y<sup>e</sup> farther discovery from Experiments upon Earth, rather then from Astronomicall observations\ 2. Whither y<sup>e</sup> vires suposed, are Not fundamentall In y<sup>e</sup> Structure of y<sup>e</sup> planetary Systeme, & y<sup>e</sup> latter Recurring to y<sup>e</sup> former /vires\ Sit liber Index:<sup>350</sup> It seem's to Me a circle. Supposing Such vires, y<sup>e</sup> planet's must have such cours, they have such Cours,. therefore the vires Supposed are true. So, In time of yore, Supposing orbs and Epicycles /solved\ y<sup>e</sup> phenomena were solved, then the solving y<sup>e</sup> /and that went for proof that y<sup>e</sup> of Reall\ phenomena proved y<sup>e</sup> other. & of y<sup>e</sup> sort were y<sup>e</sup> /orbs &c. so went y<sup>e</sup> disputes about y<sup>e</sup> time of New philosophy\ Academick disputes just at y<sup>e</sup> Entrance of new /first professed and now is it Not y<sup>e</sup> dispute w<sup>ch</sup> way will & w<sup>ch</sup>\ philosophy. & then as Now they argued that this /will not jump to an Inch? all is understood & Nothing left\ /In y<sup>e</sup> dark\ would, & that would Not solve, Ergo. 3. The Earth /Motion\ cannot accelerate by passing between venus & Mars; for they are not as Shoar's to a Current, but /as\ body's conformable/y\ floating, with others w<sup>ch</sup> Makes No coarctation at all /amongst them\. And so vast a body as that Celum with y<sup>e</sup> Earth & its vortex If such be are not perhaps in ages to be acce= /may Require ages to fixate or Retard them in\ lerated or Retarded /motion so as to be\ sensibly/e\ to us. If there were~~

a

<sup>349</sup> This leaf seems to have been inserted into the volume the wrong way round. Please read starting on 280v, then back onto this page.

<sup>350</sup> i.e., 'let the book speak for itself' (a Latin law term)

24 Nov<sup>r</sup>. 1706

[in pencil: [Astr?]]

Ans<sup>r</sup>, to a letter of M<sup>r</sup>. Clerck. dat. 25.[9<sup>o</sup>?]  
and follows after.<sup>351</sup>

S<sup>e</sup>.

I Rec<sup>d</sup> y<sup>e</sup> [fave?] of y<sup>s</sup>, of the 21. Inst, and admire at y<sup>r</sup>  
lenity In not chiding, as so many mistakes deserve  
Not for the thing, , (for what Import's it one way or  
other?) but for y<sup>r</sup> owne Sake, having y<sup>r</sup> time In=  
vaded, and also matters, with you, settled upon  
Reason's Invincible and authority Inexpugnable,  
And to say truth, such basket-attaques ought as  
children's Impertinences to be Snapt up short, or  
like Incroaching weeds be Cropt up all at once.  
ffor Enforcing w<sup>ch</sup> point of discretion, I cannot give  
you better Encouragem<sup>t</sup>, then by y<sup>e</sup> Sequel here,  
that May perhaps amount to a necessity of Mus=  
/tring\ a good stock of acrimony against Next ocassion,  
ffor p<sup>r</sup>vention of More Such Inconveniencs.

1. I deny that /meer\ Astronomical observations prove any  
vires,<sup>352</sup> ~~becaus the Causes~~ /for\ In such /that\ Imensity /causes\ may be  
Such as No observation can discover. Wherefore  
I distinguish between observation, and Experim<sup>t</sup>,  
the former perceives a thing or ~~many thing's~~ /divers\ but  
one way, & ~~In one Condition~~ /that is distinct view\; but Experiment  
perceivs the Same thing diver's way's. as the  
~~attraction~~ /force\<sup>353</sup> of a Magnet is proved variously, but

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<sup>351</sup> This note at the head of the letter is in a different ink (or pen), perhaps suggesting that it was added later (if not much later). The phrase 'and follows after' suggest that it was at first bundled with other letters, perhaps also on the subject of magnetism, and/or perhaps also addressd to 'Mr Clerck'. 'Mr Clerck' is Samuel Clarke (1675-1729), an enthusiastic promoter of Newton's works and theories (see Friesen, p. 194, n. 32) and someone up against whom RN was to rub in regard to both scientific and theological matters (text on Clark's *Trinity*). The pencil note, presumably added in the c19th, is barely decipherable and I am letting my guess at it be coloured by the content of the letter.

<sup>352</sup> i.e., 'powers', from Latin

<sup>353</sup> It is interesting that RN substitutes the word 'force' for 'attraction' here. Any confusion with the Newtonian theory of gravity, widely referred to as 'attraction', is thereby avoided. RN reserved the term 'attraction' for magnetism only.

(2)<sup>355</sup> <diagram>

To Refine A litle.

One may say that the point of Contact, is Not altogether Imaginary; as truth vary's from Speculation in all things. but ~~the smallest~~ /some\ part of the substance: w<sup>ch</sup> I will allow to be litle or great, flat[t] round or of any ffigure. Be it a flat for exampl[e] y<sup>e</sup> Doctrine is y<sup>e</sup> same.

1. As. A. shall slide, tho it touches by a superficies. E. for y<sup>e</sup> same reason as before.
2. It cannot ffall, becaus if So it Must turne u[=] pon y<sup>e</sup> point E. or F. & their is Not weight super pending Either to caus it
3. B. shall ffall; becaus y<sup>e</sup> Contrary is visible and y<sup>e</sup> Mechanicall rule of ffalling, or Rowling is whe[n?] y<sup>e</sup> Centrall perpendicular falls out of y<sup>e</sup> base, & not within it
4. It May be sayd y<sup>t</sup> y<sup>e</sup> body stopt in y<sup>t</sup> posture Shall fall faster then, when permitted to slide becaus y<sup>e</sup> Sliding answer's y<sup>e</sup> tendency of gravity in some Measure, so y<sup>e</sup> force to fall is less <flourish underline>

&lt;diagram (inverted)&gt;

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<sup>354</sup> As with the previous sheet, it seems likely that this sheet has been inserted into the volume the wrong way round; again, read from 281v first.

<sup>355</sup> '(2)' (and likewise '(1)' overleaf) is written in ink, but apparently with a brush, giving the appearance, to a modern eye, of a felt-tip pen.

(1)

&lt;diagram&gt;

w

old birds caught w chaff.<sup>356</sup>                      Horizontall plane . . . G.H.

The body. A.B.C. toucheth y<sup>e</sup> Inclining plane. D.E. in y<sup>e</sup> point. C: & y<sup>e</sup> perpendicular passing thro y<sup>e</sup> point of Contact, devides y<sup>e</sup> body by y<sup>e</sup> Center of Gravity. so y<sup>e</sup> y<sup>e</sup> part F.A.C. weigh's Equall, with y<sup>e</sup> part. F.B.C. & so posited y<sup>e</sup> body Gravitates. Quid. Inde?<sup>357</sup>

1. It shall slide, towards E. ffor by that it gaines somewhat upon y<sup>e</sup> perpendicular.

2. It shall Not ffall but Continue in y<sup>t</sup> posture, whilst it slides. ffor if it ffall's. Either y<sup>e</sup> point A. must decline or. B. but there is no force to work upon Either; or to determine w<sup>ch</sup> shall ffall. therefor neither shall ~~still~~ stirr.

3. It follow's y<sup>t</sup> if either p<sup>r</sup>ponderates, y<sup>t</sup> shall de= send, & y<sup>e</sup> body fall accordingly, and instedd of a ~~point~~ point slide upon one of y<sup>e</sup> Sides.

4. These two Motion's of sliding & falling, or as it proves in a Globe, Rowling, are not inconsistent, but both act in y<sup>e</sup> Measure p<sup>r</sup>scribed from y<sup>e</sup> laws.

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<sup>356</sup> 'old birds caught w chaff' and 'Horizontall plane G.H.' are written in another hand. The repetition of the w (for 'with') suggests someone doodling, but the 'Horizontal plane GH' has actually been added to the diagram, suggesting an editorial operation in progress.

<sup>357</sup> i.e., 'what does it mean/indicate?' (Latin: 'sed quid inde', a phrase conventionally used - by Descartes, among others - to set up a topic)

If wee thinck to have any rule for y<sup>e</sup> heavens, wee shall certainly /be\ mistaken; for the motions of y<sup>e</sup> severall ~~parts~~ /distances\ of y<sup>e</sup> vortexes are not upon y<sup>e</sup> same centers, but vary infinitely; the planets are not all, & perhaps none, in y<sup>e</sup> largest circle, if you consider y<sup>e</sup> vortex as a uniforme sphear, but they are towards it. y<sup>e</sup> moon does not move exactly in y<sup>e</sup> equinoctiall of y<sup>e</sup> earth, but vary's much from it, w<sup>ch</sup> is more visible to us, then y<sup>e</sup> variations of y<sup>e</sup> other planets, because it is vastly neerer. neither are y<sup>e</sup> circles they move in neer perfect but rather Ellipticall, as appears by y<sup>e</sup> apo - & - perigees. nor doe I think y<sup>e</sup> centers remaine y<sup>e</sup> Same, but chang every hundred years; a short time to such magnitudes as appears by y<sup>e</sup> recorded accounts of Ticho Brahe, & y<sup>e</sup> best astronomers. besides, I cannot be perswaded y<sup>t</sup> without a manufacturer, any thing in nature except y<sup>e</sup> very law's, w<sup>ch</sup> are very plain & short, is regular. tho or ages are so short wee cannot perceiv any great difference of any thing but w<sup>t</sup> is neer us. otherwise wee look upon y<sup>e</sup> world to be sphear and circles, as if it pointed to y<sup>e</sup> ey, & y<sup>t</sup> serves y<sup>e</sup> turne well Enough. untill y<sup>e</sup> or magnitude is such yt wee may inspect y<sup>e</sup> univers, as wee doe a whirle pool.

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may be Comprehended, as well as y<sup>e</sup> whole it hath  
 no vertue but as a single object, & so Each part /memb member\  
 of it. ~~And~~ It will be allowed that y<sup>e</sup> more speedily  
 a /clear\ knowledg ~~is had with clearness /is\ had /is had\~~ of any  
 multyfarious object y<sup>e</sup> pleasure of it is so Much  
 y<sup>e</sup> Greater /becaus attention & striving to Remember must be [...?]\; therefore a Regular  
 uniforme object  
~~must be so rather then the difference & Irregular.~~ /hath this vertue\  
 In y<sup>e</sup> ~~former~~ /such\ one part Explaines y<sup>e</sup> other and litle  
 attention ~~Enters~~ /serves to Comprehend & Remember\ y<sup>e</sup> whole, In y<sup>e</sup> ~~other~~ /Irregulars\ there  
 must  
 be as much time spent & attention had, to know  
 Each part as to know y<sup>e</sup> whole figure. but If the  
 parts /member?\ are /so\ indistinct & confused, so that it appears  
 somewhat should, but is Not, & after paines  
 taken, ~~is found not Intelligible~~ /cannot be understood\ that object is  
~~truely painefull to y<sup>e</sup> Mind,~~ tho Indifferent as  
 to y<sup>e</sup> use of life /is freely painefull to y<sup>e</sup> mind\ but If it Concernes life & danger  
 y<sup>e</sup> Ignorance, turnes to fear, & Remembrance of  
 paine, w<sup>ch</sup> is aggravation Enough. The like is  
 true of Mainy objects, as dancing, & y<sup>e</sup> like; Rude  
 Incondit & unequall Stepping, is odious, ffor  
 the forme of Each, is so Incoherent with y<sup>e</sup> Rest,  
 that it is forgot as soon as seen, & y<sup>e</sup> next also, &  
 so Continually, ffor the Comprehension of w<sup>ch</sup> the  
 mind hath not strength, but labour's & failes.  
 But ~~when~~ /if\ it is by uniforme figure, & comen=  
 surate step's, as when performed to Musick

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<sup>358</sup> Another non sequitur, an irregularity, but which seems also to offer some insight into non  
 sequiturs and irregularities.



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<page blank>

<LH column>

Now since all or knowledg of muscular action Extends not further /beyond\ then the /those y<sup>t</sup> [...] y<sup>e</sup>\ grosser members and ~~of [...] manifest~~ /sensible\ apparent Instruments of /palpables\ muscles that actuate them[.?] and w<sup>ch</sup> onely are subject to volition, It is reasonable to consider some one of them /seperately, them as /[angles?] or\ as opposites\ w<sup>eh</sup> And if y<sup>e</sup> fabrick of any one may be understood, as for Instance analogy will Interpret all y<sup>e</sup> rest. The tendons belong to the substance of a muscle is properly y<sup>e</sup> parenchama or flesh. y<sup>e</sup> is Soft & compressible, as /also\ well dilatible Every way, and at Each End determines in ~~sinew or tendon~~ /tendons\ or sinews w<sup>ch</sup> are hard, and stringy substances, and /yeilding\ yeild to no compressure, but being Either way fastened to y<sup>e</sup> bones, seem /as\ to be No other but y<sup>e</sup> Substance of y<sup>e</sup> muscle continued /to pass thro y<sup>e</sup> muscle from\ from one fastening to y<sup>e</sup> other And /as\ at y<sup>e</sup> muscle /itself\ devided or spread Into the changeable forme of of, fibres w<sup>eh</sup> /[. . . . .?] and In action to be con=\ distend and constrain as wee observe. In w<sup>eh</sup> /cerned so as cords to communicate y<sup>e</sup> force\ action y<sup>e</sup> tendons partake nothing but as /of y<sup>e</sup> Muscle to the parts to w<sup>ch</sup> they are\ cords to throwe on & emitt as y<sup>e</sup> muscle /annexed. from hence I conclude that the\ contracts or dilates /materiall of y<sup>e</sup> \ tendon and of y<sup>e</sup> muscle is one and y<sup>e</sup> Same but in y<sup>e</sup> muscle takes a different forme, and becomes fibres by w<sup>ch</sup> y<sup>e</sup> muscle works. These fibres are so minute No sence (however aided) can reach them, therefore wee can but guess at the /at the\ nature

<RH column>

springy disposition of them, & wherein [it?] consists. And as to that I cannot but think the fibres, w<sup>ch</sup> in y<sup>e</sup> tendon are strait /filaments\ in the muscle become spirall, and tubulous or of of some other conduplicate or convolved form repleat with some elastick fluid that so gives force to y<sup>e</sup> causeth /Each fibre & so\ y<sup>e</sup> whole to contract; for Illustration of this action, take y<sup>e</sup> Intestines of a sheep, w<sup>ch</sup> suspended at one End will hang strait, then bind y<sup>e</sup> lower End, and blow in at y<sup>e</sup> other and y<sup>e</sup> Gas as it fills, will curle up, and come neer to /towards\ y<sup>e</sup> forme as it lay In y<sup>e</sup> live animall. this will lift up a considerable weight. and Resembles a muscular fibre for If drawne downe, w<sup>ch</sup> Requires a force & let goe, it Contracts, & stands as before. This done by Every fibre in a muscle must produce a considerable force to contract & draw a member. This Seems to favour y<sup>e</sup> hypothesis of Inflation, but that cannot be, because y<sup>e</sup> muscle allwais stands bent, and altho It May yeild more or less as y<sup>e</sup> guts doe, yet y<sup>e</sup> Spring is Not /Wholly\ disabled but by death & corruption, and y<sup>e</sup> fibres being once filled, will Require nutriment, but Not to Empty & fill alternatly as Inflation supposeth; Now, can such a blast as have force to such a degree as a spring

<sup>359</sup> This folio and the two following (f. 285/6) are written on a Sacrament Certificate (see note on f. 285r, below). This piece, representing one quarter of the original sheet, has been folded so as to be in two columns. The the columns run horizontally across on the page as displayed in the volume.

bent works with; And y<sup>e</sup> Nerves Cannot be  
a medium of force to be conveyed from the  
sensorium

<LH column>

Sensorium to y<sup>e</sup> Muscle as some dream  
 ffor they are /crooked as well as\ flaccid & tender, so & can bear  
 no strain at all, but they seem to be Conducts  
 of y<sup>e</sup> nutriment w<sup>ch</sup> /to\ maintaines y<sup>e</sup> fibres all=  
 wais full; And that is [neefull?], becaus for y<sup>e</sup>  
 springs by action looseth force, & must be re=  
 cruited, as wearyness plainley shews. And wee  
 Cannot conceiv it possible y<sup>t</sup> the transit of  
 animall spirits (as they are called) should  
 be so quick coming & going as comon with  
 actions as well as art

---

<sup>360</sup> As described in the previous note, this folio is folded to create two columns. The LH column is completed as shown. At the top RH side of the page (i.e., at the bottom left of the sheet as it would be set upright), inverted, the words '..or North', also a horizontal line.

Thomas Harold of The Said Parish do severally make oath that they do know Mountague North in the above Written Certificate named, And Who now present hath deliver'd y<sup>e</sup> Same into this Court; and do further Severally make Oath that they did See the Said Mountague North Receive the Sacrament of the Lord's Supper in the Parish Church of Rougham and in the Said Certificate mentioned. and upon the day, and at y<sup>e</sup> time in the Said Certificate in that beholfe certified and Expressed: and that they did See the Certificate above written SubScribed by the Said Ambrose Pimblowe Minister. and Francis Smith Church-Warden there: And ffather that the Said Thomas Gayson and Thomas Harold do Say, upon their Oaths that all other Matters or things in y<sup>e</sup> said Certificate Mentioned are true as they verily believe.

Fra/n\cis Smith churchwarden

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<sup>361</sup> Like the previous folios this is also folded, although in this case the sheet is set in the volume with the fold running upright. This is part of a Sacrament Certificate, required under the Test Act of 1673, required for anyone taking up an official military or civil post (Montague graduating from Cambridge?). It is phrased in the standard wording. Thousands of these are kept in county archives, all over the British Isles. They were originally lodged at the Quarter Sessions (or, if within 30 miles of London, at Chancery, the Exchequer Court or the King's Bench). Why this one is not lodged with the authorities is a mystery - perhaps it is a copy. The Sacrament Certificate was required until 1829 when, under the terms of the Sacramental Test Act of 1828, prospective officials had only to swear not to injure or weaken the Protestant church. This is written in a legal hand, it has been signed by Francis Smith and annotated ('churchwarden') by Ambrose Pimlowe (see f. 286v, below, for Pimlowe's signature and the Sacrament Certificate itself). The certificate is dated January 1730 (which could be January 1731, for us; until 1752 England continued on the old calendar), giving us a pretty unambiguous terminus post quem (once decided) for the notes on the reverse.

of 3, I terme one y<sup>e</sup> power the second y<sup>e</sup> mean &  
3<sup>d</sup> y<sup>e</sup> Resistance.

The power acts with More or less force according to the  
obliquity of y<sup>e</sup> Impuls and y<sup>e</sup> obliquity's on Either Side

The Mean Separates as p<sup>r</sup> y<sup>e</sup> Rules.

The Resistance may be direct ag<sup>t</sup> y<sup>e</sup> mean or obliq  
<diagram> If direct, The Impuls is Either on both  
In ~~y<sup>e</sup> Successively,~~ or at y<sup>e</sup> same Instant or  
Successively. If at y<sup>e</sup> Same Instant, y<sup>e</sup> Case is  
as upon one body Equall to both; If succes=  
sively it is as 2. Impulses. that is one upon y<sup>e</sup> mean &  
y<sup>e</sup> other upon y<sup>e</sup> Resistance. C.

If oblique as B.D. and in y<sup>e</sup> Same Instant, then there  
Must be a separation of both, with turning, upon y<sup>e</sup> center  
of Each, more or less swift as y<sup>e</sup> Resistance is less. for If the  
Resistance is Inconsiderable, B will turne with litle celerity

The ~~point~~ Resistance is allwais by a point nearest to  
direct upon y<sup>e</sup> mean, w<sup>ch</sup> hath most force as.  
If y<sup>e</sup> Resistance be great the Inception of the turnings of  
y<sup>e</sup> mean will be y<sup>e</sup> fall between the center of y<sup>e</sup> mean and  
the Contact as upon sompoint in y<sup>e</sup> line Ba; but If strait  
Removes to y<sup>e</sup> true center B.

If y<sup>e</sup> Resistance be Infinite, as y<sup>e</sup> fulcrum of a lever or  
center of a ballance, without freedome to y<sup>e</sup> Mean to  
Remove, that will Continue y<sup>e</sup> center of y<sup>e</sup> Machine.

This Contact being ~~mad~~ become y<sup>e</sup> Center all the obliquitys of y<sup>e</sup> ~~bea~~ mean and y<sup>e</sup> consequences of that are Referred to that Center, ~~See that y<sup>e</sup> place's when the~~ /w<sup>ch</sup> I call y<sup>e</sup> Mechanick center\ ~~turnings will be most swift, will have much force of all swifter movemts have.~~

<diagram crossed out> If the Resistance falls in the direction of a motion meerly regressive, the state is a ballance and No part shall move ~~swifter~~ Such is a beam In y<sup>e</sup> way of Gravitation w<sup>ch</sup> hath allwais y<sup>e</sup> Same direction, and that direction is described by y<sup>e</sup> path of its true Center.

Now as y<sup>e</sup> true center delines from y<sup>e</sup> Mechanick Center the obliquity Increaseth, and the force of y<sup>e</sup> beam to discend derives, and Larger portion hath Most force and Makes y<sup>e</sup> beam turne upon the ~~mags~~ mechanik Center as

<diagram> as BC - y<sup>e</sup> beam of uniforme substance in Length.

A. the Resistance, Infinite.  
B and C. mechanick Centers

[in margin: Norffs<sup>362</sup>] Wee Ambrose Pimblowe of the Parish Church of Rougham  
in the County of Norff: And ffrancis Smith ChurchWarden  
of the Same Parish and Parish Church do hereby -  
Certifie that Mountague North of Rougham in the  
Said County Gent. upon the Lords day commonly called  
Sunday, the third day of January Immediately after  
Divine Service and Sermon, did in the Parish Church  
aforeSaid Receive the Sacrament of the Lords supper  
According to y<sup>e</sup> uSage of the Church of England.  
In Witness whereof we have hereunto subscribed -  
Our hands the 20th day of January 1730 - -  
Amb: Pimlowe Curate of  
Rougham for the Said office

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<sup>362</sup> Norffs, the conventional abbreviation for Norfolk.



~~thinking y<sup>e</sup> best astronomers will p<sup>r</sup>tend it /But as other measures, take up with a litle more  
 or less and Never Expect. the most correct table they can make Shall last long true, but in  
 time grow full as they/as\ hath [befalen?] before 'em to others\ And  
 as to Gravity the Same of y<sup>e</sup> difference is between /no less carefully made before them, grew  
 as those now are fals.\~~  
 Attraction in vacuo, and Equilbre in plenu /And whereas you alledg all y<sup>e</sup> cours & aspects of  
 y<sup>e</sup> moon are Resolved\  
 It is all Gravity Still, as weights In scales weigh /by gravity onely, wee say y<sup>e</sup> Same [...?]  
 but ours ownes an Efficient\  
 No less for y<sup>e</sup> Counterpoise, therefore the Resol= /caus, y<sup>rs</sup> None. Wee thinck wee understand  
 some what of it, If Not all\  
 ving y<sup>e</sup> Aspects & anomala by Gravity wee doe /you disowne to understand any thing. Wee leav  
 much to Ignorance\  
 Not {Orbes?} contradict. /& accident, your Machine is\ mathematically Exact, Even as y<sup>e</sup>  
 /orbes of Ptolomy, & there is y<sup>e</sup> State of this difference.\<sup>364</sup>

2. I doe /may\ Not Enter Into y<sup>e</sup> penetralia of Geome=  
 try to weigh y<sup>e</sup> Niceness /be Judg\ of /the\ demonstration about  
 y<sup>e</sup> /Reciprocall\ Efficacy of y<sup>e</sup> Supposed vires; as to /or\ Resolve why  
 wh water from a foramen neer y<sup>e</sup> bottom of a /under great pressure and Issuing in a small  
 thredd\  
 [...?] (we<sup>h</sup> would Shoot strait a great way, but /is so soon drawne downe by Gravity, and y<sup>e</sup>  
 vis Impressa of y<sup>e</sup> planets\  
 for Gravity,) Should be so soon pulled towards y<sup>e</sup> /to move Equally in direction (Not unlike y<sup>e</sup>  
 other\  
 center in a parabola, and y<sup>e</sup> vis Impressa of y<sup>e</sup>  
 /medium [lunders?]\ planetts /to Move we<sup>h</sup> is Equable /Equably\ in direction Not unlike y<sup>e</sup>  
 other, but as y<sup>e</sup>\ be drawne In to a certein distance  
 & there stop, & be held, as a stone In a Sling,  
 by a counter working of those vires, & Not goe  
 on, tho y<sup>e</sup> /centripetall\ force on our Side Grow stronger /deminisheth\ conti=  
 nually. But /In y<sup>e</sup> room of this\ Grossly fancy that (admitting all,) that,  
 /[...?]\ If a ballance /of forces be as I thinck it\ be supposed, and one side /y<sup>e</sup> planet\ by  
 acci=  
 dent (as /hicht\ a litle remoter position from y<sup>e</sup> Center)  
 gets a/n\ litle y<sup>e</sup> better, advantage, to is /It must needs be\ Gone towards /In\  
 the /way of\ direction, & on y<sup>e</sup> other Side/side for alternate caus possibly,\ towards y<sup>e</sup>  
 center  
 And you seem to Joyne with me in this, by a pa=  
 rethesis [unless it be Increased to a very great  
 degree]<sup>365</sup> I ask What degree? Every degree (Mathe=  
 matically) so p<sup>e</sup>ise determines an Equilibre.  
 And when comes a New force to Recover it? and  
 It seem's y<sup>e</sup> planet's courses are p<sup>r</sup>cisely Mathe=  
 maticall

<sup>363</sup> This would appear to be a draft for a letter. Is this folio reversed? does the verso precede the recto?

<sup>364</sup> This whole paragraph has been half-heartedly crossed out with two diagonal lines.

<sup>365</sup> RN uses a square bracket here, this is not an editorial intervention.

a /altho wee allowed (as wee doe not) some\ Caus, ~~such as Comon Impediments are~~, for it. Much less in such a point of time (Comparably) as that Aspect Continues; 4. Saturne is allowed to be, In our sence, Cold ~~weh may~~ /enough & that\ justly be Esteemed a Small Caus /that Reflection of heat from there ~~might warm it~~ that ring might warm it.\ of ye Ansa<sup>e</sup>; And Mercury May be also Hott, and both as all ye Rest of ye planets /be\ compound of Materiall apt for ye position. Saturne May thinck wee burne as wee ~~thinck of~~ Mercury, ye one May be unctuous & ye other Gold, while wee In a Medium are water Earth & stone. But heat & cold are Not as distance from ye Sun, but as Reflection and War=  
mable stuff occasion; So that I conceiv all the Arithmatick bestowed In ye Calculates of heat /neer ye Sun\ is lost. 5. Why Should Not ye Irregularity's of ye Moon and ye Rest of ye planets be reall Irregularitys fortuitous & Inexplicable? tell Me any one Naturall thing In particular that is Not so. per=  
haps wee hold, as Aristotle, celum Imutabile,<sup>366</sup> ~~or~~ /and\ on account of dignity assigne it ye cheif place in /thinck there is a dignity to a decorum, In More precise\  
~~the Geometria practica. Generally rules May have~~ /a rule more than ordinary place from observ Repeated\  
certainly; /Experim<sup>ts</sup> carry There may be generall rules certain Enough.\ But In application ~~to~~  
~~praetis~~ Every /to particulars in practise Every\ thing hath unaccountable and Inexplicable accidents & measures. And why great things Should be mathematically Exact, and Small ones, w<sup>ch</sup> wee better know, Not so. I cannot ans<sup>r</sup>. Nor why Casualty about ye planets Must needs be Explicable, or that an hypothesis, becaus it fitts them, must be true. there=  
fore as to ye p<sup>r</sup>cisely Regular, I beg pardon, scarce  
thincking

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<sup>366</sup> i.e., 'unchangeing sky', i.e., that unlike on Earth, there are other rules applying in the rest of the universe beyond the orbit of the moon, and that the heavens are perfect (RN contests this ubiquitously).

of the granada would be Spent against y<sup>e</sup> yeilding of that  
 compressure, as when a thing falls upon a wool or y<sup>e</sup> like  
 and the force ceasing y<sup>e</sup> body of water ~~(as supposed Compressible~~  
 as a Spring would Returne Into its place as before.

~~forces that,~~ The compactness or Resistance of fluids is Much  
 owing to the power of Gravitation, W<sup>ch</sup> keeps the parts together,  
 and Resists that wee call a Torricellian vacuity, that is by  
 deviding /or making holes in\ the fluids Make /for\ If Gravity did Not Compress y<sup>e</sup> parts  
 together, leav /there would be\ a Space /made\ filled onely with a more Subtile  
 fluid, and y<sup>e</sup> More Gross be raised & stand Rigidly /up\ as  
 y<sup>e</sup> Grassy turf doth where a mole hath passed /but\ The weight  
 constring the fluid y<sup>e</sup> passage /movem<sup>t</sup>\ is accomodated by [cassion?] of parts /w<sup>ch</sup> closed as  
 fast as they\  
 that /w<sup>ch</sup>\ will Require /[time?]\ to\ a degree of slowness, according to its /the\ Spissitude  
 of  
 y<sup>e</sup> fluid. And whatever Move Swifter the y<sup>e</sup> force of Gravity can  
 actuate y<sup>e</sup> matter to fill in as fast behind, there is a reall  
 Toricellian vacuity Made there, And I thinck this may be discerned /by a bubble abaft\  
 by a buble /w<sup>ch</sup> I thinck ~~appears abaft.~~ When some things re urged quick ag<sup>t</sup> a /Strong\  
 Stream,  
~~y<sup>e</sup> may be tryed, by a buble [...?]\ /appearing\ abaft.~~<sup>368</sup> highs small, low Great<sup>369</sup>

that it, Either hammers on an anvill, or chopping of wood,  
 In Either of these, the Hamer Moving gives y<sup>e</sup> air /comon\ about it a  
 motion Conformable; and at y<sup>e</sup> Stroke, y<sup>e</sup> hammer is Stopt in an  
 Instant, but y<sup>e</sup> air is Not Stopt, but flows on In y<sup>e</sup> Same Cours till  
 It makes a condensation, & from thence, of Cours a wave. The place  
 of y<sup>e</sup> force must be Stationary, becaus /Instantaneous for\ y<sup>e</sup> Wave springs from a  
 center.

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<sup>367</sup> ff 288 and 289 are a single sheet folded. This sheet is part of a legal document relating to land in Segeford, Norfolk (a village about 15 miles north of Rougham) which, as a legal document, had been annotated by RN, presumably previous to being employed by him as wastepaper for notes. The document is turned upside down in the volume.

<sup>368</sup> A single line crosses out this section of the page. There are several ink spots on the page near the top. A row of dots between lines 15 and 16 may be an indication of (what in accordance with the many corrections may be) a reflective pause in the process of writing.

<sup>369</sup> These four words are not part of the text, *per se*.

Sedgfords in Sedgforth & also whose and all and every the Rights Members and appurts thereof.  
and also all that Messuage & ffarme Lyeing in Sedgford & Eaton aforesd now in the use of  
[Rachael?]

Thompson widdow her also [or and sons?] with all & Singular the Lands & [Hewditfam?]s:  
thereunto -

belonging or therewith used as part or [...?] thereof and alsoo all other the Lands and -  
[Hewditfamens] herein before mentioned stituate & being in Sedgford aforesd & Lyeing in the  
Towne & feilds of Sedgford and Eaton aforesd or either of them now in the [Towne?] of Edmund  
-

potter, Rob<sup>t</sup>: Dunham, fframingham Lake or Adam Royston and or either of them their  
any or other of their respective alsoo or [...?]'s - with all & any the appurts  
respectively /&

All every or any of the Said last mentioned p<sup>r</sup>misses, or any part or parts  
parcell or parcels thereof with the Appurtenances Respectively\

/In and by the same wrighting or wrightings or any a last will or any other wrighting as  
afored\

and Shew of from time to time & att all times hereafter to Lymitt & appoint Such new  
and other uses to Such other person and persons & for Such Estate & Estates And Subject  
unto Such Charges ...<runs off bottom of sheet (sheet is trimmed)><sup>370</sup>

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<sup>370</sup> This really is the best I can do for the moment; it is my first encounter with this kind of provincial legal hand, no doubt transparently legible to many. I need either to do some practice, or call in an expert. The /insertions\ are in RN's hand - a firmer (and younger?) hand than the notes on the next page. The transcription is more right than wrong, and its nature is clear enough. The document occupies the RHS of the double page, and thus is principally on the 288v side of the sheet and upside-down (since the sheet is inverted).

[Stop?] not  
yet.

It hath bin allready observed that all the variety /of modes\ that can be  
made in ye force will be perceived in ye Effect, that is the sounds  
thereby Induced. It is Impossible to Instance in all these, for who  
can ans<sup>r</sup> for ye rare all ye differences of that sort/s\ /of Noises\. therefore wee  
Shall touch some, y<sup>t</sup> are moat significant. And first, the difference  
when the pulses are quicker and slower, ~~the very view of~~  
~~actions that are so Short. Re=~~ /whereof the perception distin=  
~~turnes, there less then larger;~~ /guisheth by that w<sup>ch</sup> the musi=  
~~The sence of~~ /tians Call Sharp\ and flatt. and  
if the difference widen's one Ex=  
tream is the Ceasing of the tone  
and becoming distinguishble as  
comon percussions /for where distinction ceaseth tone begin's\and ye other is  
what wee call Shrill, W<sup>ch</sup> maybe so  
sharp, as not to Joyne with one tone  
more then another, & so Ceaseth to be  
a musicall tone.

It being most sure that, the pulses of the String upon ye air already  
described, are Equall timed, wee conclude that a musicall tone, ye effect  
of it consists in that property, ~~the~~ for whatever other alteration happens  
to diversifie the Sound, that never failes, but the String let alone to vibrate  
as it is disposed, shall allwais produce  
a Musicall tone, and so the Ichronisme and Steddy tone prove the con=  
nexion of Each other. ~~If ye Spring be overstrained at first It will vibrate~~  
there this State of ye pulses in Equall  
[time?] may be varied to swifter or slower. 1. by adding weight that is  
Inlarging ye body that Moves, for ceteris paribus /in ye force\ Great body's /are mad to\ move  
Slower  
then Small ones, 2. By Invigorating the spring, that in a string is practist  
as Increasing the tension and the  
device ~~by of~~ for doing that  
by turning a pinn is  
well enough knowne, ye other is  
done by using a larger string, or  
[Gimping a Wite?] round it, or any thing that make is heavyer, hereby wee  
obtain the variation of tones as to flat and Sharp ad libitum

our next task is to Discover the Reas causes of So much diversity of Sounds as wee by hearing are so sensible of. and with such variety that it is a question whither the whole world shews us More then wee have by y<sup>e</sup> Sence of hearing. And all these changes are connected with y<sup>e</sup> modes of the force that causeth them. therefore wee may consider ~~by~~ /from\ what kinds of force Sounds proceed; It was observed A bare protrusion of air creates none, as y<sup>e</sup> falling of a tower till it comes to the ground, but then the Nois is great so the moving of an ax or hammer makes no sound till it meets the Block, and then it is heard farr Enough, and Numerous Instances of this kind perswades me that it is a start onely & No More y<sup>t</sup> Emitts a Sound, and I suspect that No Motion Continued Sounds, but as it may occasion Starts of the air. And of all ~~ether~~ the most considerable is when on a sudden ~~the~~ a torricellian vacuity is permitted to close that under y<sup>e</sup> vast weight of the atmosphear, must needs come together with great violence, and then Stopping ag<sup>t</sup> it Self, the Imprest force makes a compression of much air together, w<sup>ch</sup> starts forth again and, by undulation law makes a wave, w<sup>ch</sup> is Sound.

~~In cases of /upon\ percussion, Some by /of\ divers solids upon Each other Some part in th dye in y<sup>e</sup> Stroke as /[vis?]\those that make way as chopping wood.<sup>371</sup>~~

But Now Coming neerer to the distinction of sounds, w<sup>eh</sup> I propose, that however y<sup>e</sup> movement of forces In the air are the Caus of the Sound, but Imediately It is the action of y<sup>e</sup> air agt it Self, & Not the force of y<sup>e</sup> movemt that is y<sup>e</sup> Caus. And this Must be Judged by Reflection upon particular's; the Most obvious mean's of Sound is percussion, that may Either In y<sup>e</sup> Same moment Reflect, or following somewhat, as fall on a yeilding body. the 2. first shave a Share in comon &

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<sup>371</sup> This part of the text is struck out with a single diagonal line.

ffor there is No mean, Either all is perpetuall Miracle, or thing's ordinarily as Reciprocally causes hang on one to another. And as ffor the Hints to y<sup>e</sup> sagacious /~~[you?] formerly [touched?]~~, I find very [~~mutch?~~]\ Really plaine dealing is a Jewell, and I never yet knew a fair reason to wrapp up phisicall truth's, as is sayd of y<sup>e</sup> pythagoreans, in affected obscurity, unless it were Either to advance a trade, or fame of more then is true, ~~and at best It savours of y<sup>e</sup> saltinbane.~~ Nor can I beleev, tho many by their proceeding's ~~seem wiser~~ /seem to fear it\, that Naturall filosofy in y<sup>e</sup> most perspicuous dress, Ever hurt any sort of goodness, Nor is that such, w<sup>ch</sup>Ever it be, y<sup>e</sup> steals out of y<sup>e</sup> way of a Right understanding.

Now having toucht on y<sup>e</sup> principia, & y<sup>e</sup> title, It were uncivil to let it pass, without a Note to y<sup>e</sup> matter; And out of a sea of that, I choos the first thing, absolutes & Relatives; and of them Motion, w<sup>ch</sup> is distinguish't In to Motus verus, and Motus Relativus; and that Endeavour'd to be made good by Experiments; w<sup>ch</sup> goe No farther then the case of turning, to w<sup>ch</sup> I say Nothing at p<sup>rsent</sup>, but desire to know your thoughts, whither a body be capable of **Vera Quies, and motus verus<sup>373</sup>** (I use y<sup>e</sup> words) at one and the same moment of time; ~~and to make y<sup>e</sup> proposition~~ /and then I may give you a far=~~clearer, I mean upon y<sup>e</sup> same~~ /ther trouble upon that point\

of them in y<sup>e</sup> Query's After y<sup>e</sup> optick's, w<sup>ch</sup> ~~altogether are too much to take in hand~~ And when y<sup>e</sup> Great Author hath ~~Shew what~~ /~~[...?] affords us our hope's~~ \ ~~he gives hopes of~~, I dare say wee Shall have a New World In filosofy. ~~In y<sup>e</sup> mean time~~ /but all that lye a great\ way behind, & it is a mountaine to be Removed to come at it.

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<sup>372</sup> Although, again, about Newton's Principia, this seems to be addressed to someone (para 1, line 3; para 2, line 8) if one reading is taken.

<sup>373</sup> The terms are the ones used by Newton for 'relative motion', 'absolute motion' and 'absolute rest'

ffor there is no Mean, Either all is perpetuall Miracle or things ordinary, as Reciprocal couses, depend on Each other. And It is Easy to Say matter is Induced with property's, to any porpose, but More /Great & \ Glorious If one property be shewed /truly\ to subserve all /sensible and probable Insensible\ porposes; And that of universall attraction

I am sure ~~may be shew~~ by Experiment /as May be [Made?] to Enervating Gravity\ ~~shewed to be fals~~.

~~And ye Case is Not ye same, to argue a property from an Effect, as to argue an Essence from proof. for ye E~~  
~~And it is a Shrew'd signe, when it is Intelligible, ffor really /may\ be proved to fail; wch is Jugulum causa<sup>e</sup>. And wch is Jugulum causa<sup>e</sup>,<sup>374</sup> It is a shrew'd sign, When~~

And It is a an Error of ye first Concoction, to use a principle which any one may pleas to deny; & it is labour hazarded If Not lost to superstruct Elaborate demonstrations on Such.

~~It were a great work to sift all that belong's to this subject In those 2 great works of ye principia, & ye opticks. Wee May~~

I find by ye latter /opticks wee may\ hope for an Explication, or rather demonstration of ye principles, Either by Sense /clear Sensation\, or Necessary consequences (for /really\ less Will Not Serve /doe\). And then Expect a /Reformed\ /If not a\ New world of filosofy; and /when surely\ No Notions /will be\ Current, but What are clear & distinct or necessarily deduced from

Such as are so. ~~And If wee can be content, Not to know~~ /and Esteming o'selves Not oblidged to be om=

~~all things, but~~ /scient but be con\tentd In many thing's to Remain Ignorant. and Not reject plain verity's, becaus they will Not fitt all cases.

I find In ye opticks, In a Quere dress, a ~~vast Compass~~ /much proposed to Render\ ye principall of attraction /and some other uses [...?]\ plausible but Nothing to prove it but ~~what~~ /the constant\ method of Hypothecarian's, that is, disabling all other solution's, and applying this in their room; & then Concluding from aptness. and however some ~~matters are palli~~ /objections are seemingly obviated\ ~~ated~~, as it is not like occult Quality; it may possibly be by pulsion, (that is it may /be &\, not be as is supposed) at all, for pulsion & attraction ~~have different~~ /are two\ Notions) & ye like. ~~yet the~~ it is Grosly maintained. and semes to be contradictory on some things, as one while ye attraction is according to density & another then small bodies &c

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<sup>374</sup> i.e, 'the essential thing to be proved, to be true'



Argum<sup>ts</sup> demonstrative of y<sup>e</sup> deity are of Such various Natures, that Each state & capacity of Mankind hath them. The clowne by y<sup>e</sup> process of his labour In producing, when he sleeps, and y<sup>e</sup> favour or Inclemency of seasons. The gentleman, by y<sup>e</sup> beauty & order of the world. The philosofer, by the connexion of Soul & body, w<sup>ch</sup> is the Most cogent of all.

In Circular forme, Every point of the periphery, is also a point of a tangent there and also a point of all possible Curves y<sup>t</sup> Can be tangent to it. then w<sup>ch</sup> shall a body take of all these, I say y<sup>e</sup> Strait, viz<sup>t</sup> tangent for what should set it into one or other of y<sup>e</sup> Rest?

291v

<page blank>

Matter Indifferent to Move or Rest. & y<sup>e</sup>  
use &c.

It is so true, but hath not such Consequence  
ffor It Imply's no more but Every touch Influ=  
enceth Every body, be y<sup>e</sup> disparity never so  
great, but Not In quantity. for a Small body  
will not Influence so much as a great one will.  
much less a small one make the greatest Move  
In the Same celerity, as they say; Refuging from  
Experienc, to vacuum. but the just consequence  
is Every touch doth somewhat, more or less  
is a farther Inquiry. and the touch or No touch  
is but as Influence and no Influence. and as  
touches vary so Influences must vary. and to  
Shew this fancy sticks in meer words, put it  
thus In y<sup>e</sup> Same words. matter is Indifferent to be  
of any figure, round, or square. and therefore Every  
force tending to Either Shall make it So.

- The variety Matter is capable of is  
Comprised in these Devision, figure  
& disposition, y<sup>e</sup> chang of w<sup>ch</sup> is motion.

- [Same?] Motion in y<sup>e</sup> World. - Considering  
y<sup>e</sup> Connexion of all y<sup>e</sup> Matter of y<sup>e</sup> world, to  
yt no p<sup>t</sup> is moved but y<sup>e</sup> Whole univers is  
Concerned, It May be true.

This is Not a case In Simple motion, for  
that may be anything by [Relatios?]. Complex [tolls?] that

Qu. how Spirits may act Move or divert?

Remember Actuall Infinity, they say ye ~~Ques=~~ /case\  
~~tion~~ Returnes allwais, ffor however Small, It is  
 body still, & how can spirit act; I say, true  
 body but continually more passive, & what Must  
 that End .. In?.

<diagram> Mathematicians fail In their language [if?]  
 words are not Construed to man's Intent. as  
 the hyperbole & its symptote, meet in a  
 point Infinitely distant. ye Word meet is fals.  
 and the point, is No where. the sence, or  
 reality of the case is from ye notion of Infinity  
 1. that there is no End of multiplication.  
 And the extending ye curve & strait line's  
 do but aggrandise ye Cone: and then it is  
 the sume to say a Cone may be aggrandised  
 by extension of ye base In Infinitum. 2. that  
 space ~~may be~~ /is\  
 devisible in Infinitum. ffor  
 If ye section be paralell to ye axis, It may be  
 neerer it then any given distance, & yet Not  
 in it, & then ye section will be hyperbolick  
 till actually coincident with ye axis, & then  
 it is a triangle, quasi asymptote. so that Respec=  
 ting ye part of ye Cone abscinded. It is all one  
 whither in a Small cone ~~yeu~~ ye Section is neer  
 or In a great one farther from ye axis in one  
 Greater. and If you either Conceiv ye Cone ag=  
 grandised, or ye Section neerer ye axis, it is ye Same Case.<sup>375</sup>

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<sup>375</sup> marg.: 'Infinity Succeeds both ways, [& one?]'

## Actuall Infinity.

1.

But there is another sort of Infinity w<sup>ch</sup> I call actuall,  
w<sup>ch</sup> is of ~~that~~ /Greatest\ Importance ~~to~~ /In\ y<sup>e</sup> Science of Nature, ~~that~~ /therefore\  
I Shall take a litle more Care to Explain it.

That the Matter of y<sup>e</sup> World, Increasing from us, Is /actually\  
Subdivided into small parts, Every one admitts, ffor  
all y<sup>e</sup>-~~action~~ Motion, Especially that of fluidity, de=  
clares it; and wee live /in\ and perceiv so much of it,  
that Nothing can be to us more notorious. And for  
that reason ~~wee have~~ ~~No~~ there cannot be actuall  
Infinity of Simple magnitude In y<sup>e</sup> Way of Inceas, but  
by composition of divers Ingredients, And then It amounts  
to y<sup>e</sup> Idea of Infinite Space, & No other. /& here doth not concerne us, so\ ~~But~~ In the  
way of ~~Deminution~~ Subdevison, it is No less agreed  
that, Mentally, ~~the~~ Every ~~particular~~ /Individuall\ particle of Body  
is devisable, ~~and so~~ /& subdevisible\ ad Infinitum. And that w<sup>ch</sup> the  
Ancient's meant by atome or Minimum, is Not  
~~Extant in Nature. And how fare it is practicab~~ /found in Rerum natura,<sup>376</sup> This is not our  
porpose ~~neither~~ nor how\  
~~to divide things~~ /farr body's may (if at all)\, (w<sup>ch</sup> consideration belong's to another  
place, practically separated; ~~by~~ for that depends on the  
mechanicall application of powers, & Resistances y<sup>t</sup> May  
be ag<sup>t</sup> them. And that w<sup>ch</sup> I here affirme is, that In Most  
places there is matter Intersp<sup>r</sup>'t that is actually Small  
ad Infinitum, that is there Shall be Some smaller then  
any magnitude assignable, ~~So~~ /and\ propose /any\ y<sup>e</sup> Magnitude or  
Space, I affirme there is matter Not farr off actually  
smaller; As In y<sup>e</sup> compass of a Dye, the Interstices ~~are~~  
contein a matter Smaller then y<sup>e</sup> Component parts,  
and those have Interstices, conteining farther Smaller  
& those smaller ad Infinitum. so that y<sup>e</sup> Space of y<sup>e</sup>

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<sup>376</sup> i.e., 'natural things'

Dye is perfectly - Infinity<sup>377</sup> - repleat with body 2  
 Greater & Smaller of y<sup>e</sup> latter actually Small ad Infi=  
 nitum. ~~the use of this will appear afterwards In y<sup>e</sup> Mean  
 time I shall take notice of what may be sayd for or  
 ag<sup>t</sup> or for this Notion held for to alledged on y<sup>e</sup> other side  
 I think since it cannot be proved Impossible  
 It will be harder<sup>378</sup>~~

And farther wee say this Notion Implying  
 no Contradiction, ~~It is~~ Nor Inconsistency /[...?]\  
 with any knowne Existence/ssence\ or Mode of  
 of naturall thing's, admitting also that  
 It may or May not be it cannot be by any  
 arguments proved it is Not, ffor [if?] there is ther Colour  
 of argument that way, but the ~~ether~~ for it, there is  
 If Not direct argument /proof good\ reason /besides y<sup>e</sup> use as I shall Shew\ to p<sup>r</sup>sume it is  
 so,  
 for by all /y<sup>e</sup>\ observation /weakens\ wee can discerne Nothing smal=  
 ler then /some\ animalculi;<sup>379</sup> for by Extraordinary Magnifica=  
 tios by Glasses, such /just\ appear, & are ~~but just~~ discerned, so  
 as to ~~dis-observe~~ by to have animall life from their  
 members & activitys. and yet wee must gather wonder=  
 full further minuteness in y<sup>e</sup> animall Spirits of those  
 creatures; And In Short, ~~all-observation seems~~ /dioptrick glasses\ by disco=  
 vering no symptome of limits /menimums\, but ever of /yet\ farther de=  
 minutions. to argue that Smallness is a the like ~~proves~~  
 may be ~~or rath~~ /If art could lead\ us farther, proceed to actual Infinity  
 of Smallness. Therefore And it is agreeable to the  
 Notion Infinity In y<sup>e</sup> way of Increas, for one admitted  
 Seems to Include y<sup>e</sup> other, as ~~there can be No Infinity~~  
 If ~~there be a~~ /all\ termination seem's to contradict Infinity.  
 And the world Shewing no symptome of limitts It is Not

<sup>377</sup> RN has started writing before putting in his header and page number, thus the confusion of elements on the first line. There is a patch of the white, chalky material on the upper part of this page.

<sup>378</sup> There is a correction inserted here which becomes a marginalia, the text in the latter part of the paragraph (from "I think since ..", subsequently crossed out) is written around the marginalia indicating that it was added later than the marginalia. Correction/marg.: 'And you may by y<sup>e</sup> Same way ~~of-arguing~~, argue ag<sup>t</sup> devisibility as ag<sup>t</sup> actual smallness ad Infinitum, for what may be, ~~cannot~~ mentally cannot be proved Impossible /to be\ actually and If there be great [...?] /need\ it should be so, as I shall shew It is highly probable it is so ~~but for~~ /as may follow\ whch I shew the use of this affection w<sup>ch</sup> is of another place.' Farther down the page more marginalia. First a calculation, perhaps of annual rent or wages:

10  
12  
 20  
 10

and next to this another, which seems to refer to a two-year cycle:

[b?]/240/20

Further down two columns calculating the passage of time (presumably working from November 21, 1695), thus:

<del>21 N<sup>o</sup> 1695</del>	1700
6	1
7	2
8	3
9	4
	5
	6

<sup>379</sup> The name given to the tiny creatures observed through microscopes.

reason to p<sup>r</sup>scribe any. These I Say Not for demonstration  
but for Colours /or probabilities\ Such as all Naturalist's Even y<sup>e</sup> Most  
Rigorous have thought ffitt Sometimes to Entertein them., but  
after all Qualibet Inden esse.<sup>380</sup>

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<sup>380</sup> i.e., 'this is what you will'. There is much crowding to the bottom of the page, suggesting that the essay, in this version, ends here.

13.

## Extent.

It seems reasonable to thinck that the world,  
 extent, or Content of it, The Receptacle of body['s?]  
 Such as wee are sensible of together with body  
 it self (If Not y<sup>e</sup> Same /thing\), is without limits, or as y<sup>e</sup>  
 phrase is, protracted out Every way ad Infinitum.  
 If wee suppose limits, the Question Returnes, of what?  
 The ans<sup>r</sup> must be Nothing. so theres an absurdity  
 limited with Nothing. but Not to Cavill, lett matter  
 & Space loos, without positive limits. What is there  
 to Resist any thing passing to the limits, and so  
 on. If there be no room, beyond it must stop,  
 at what? Nothing. Is Nothing Hard, or Impe=  
 netrable? Thus upon y<sup>e</sup> whole I find space once cre=  
 ated /to\ be in its Nature, Infinite towards greatness  
 as towards litleness, to be declared afterwards.  
 ffor Conceiv what thing you will, If you Con=  
 ceive also a process towards Infinite smallness,  
 I cannot Reconcile, but that argues the like  
 y<sup>e</sup> other way. for any given Quantity is Infinite=  
 ly Great, If you Suppose another Infinitely Small.  
 Wee Will leav this Jargon of Infinity, w<sup>ch</sup> however  
 Reall In nature hath No place in our con=  
 ception, becaus it is Not an Idea, but /of\ a pro=  
 cess, repetition or Hypothesis onely. and saying  
 onely

---

<sup>381</sup> The essay fragment on this sheet (continuing to f. 297v), is clearly a separate project from the previous sheet. Although dealing with a similar subject matter, the pen/ink/writing differs; also, this essay is more finished both in conception and presentation.



onely that It may Evince to a degree of probability: ~~but~~ A Stronger argument ~~then~~ is from Experience, tho, being onely Negative, Comes not up to demonstration. It is Most certein wee know No limits, and by no Experiment or discovery, can draw y<sup>e</sup> least hint of any. but on y<sup>e</sup> contrary discovery's have vastly Inlarged y<sup>e</sup> World to our Notice by opening y<sup>e</sup> Curtaines of y<sup>e</sup> Sky's, and Shewing Immensity Beyond all former thought and Imagination, and that by opening worlds supposed centered with fixt starrs /beyond thought\ Numerous and still farther off, & yet Nebules, to argue More /& farther\; all w<sup>ch</sup> seems loudly to pro nounce Et Sic ad Infinitum. Nor doth this Notion at all Impeach y<sup>e</sup> Infinity of y<sup>e</sup> Creator, ffor why Should Not his work's be Infinite, & this one of y<sup>e</sup> World or Space, In y<sup>e</sup> way of Extent; as Infinite others may be, In other Respects, Not dream't of by us? But whither Space be limited or Not, Is a matter of free choice to maintaine, & each may hold his opinion, without Impeaching our process of Naturall filosofy w<sup>ch</sup> lean's Not upon Either.

There,

There have bin In our academy's some frivolous disputes about this, as whither wee perceiv any thing In its true magnitude? & y<sup>e</sup> like. It is Ea= Syer to ans<sup>r</sup> there is No magnitude, tho it Sounds odly, then that wee perceiv any so, or not. becaus Magnitude is realy Nothing in it Self, but as it is Compared with Magnitudes with w<sup>ch</sup> it holds proportion, as 1/2<sup>th</sup>. 1/4<sup>th</sup>. 1/9<sup>th</sup> &c<sup>a</sup>. ffor the Content of a Quart-pot, is as to all Imaginable Inferences the same thing, as y<sup>e</sup> Sphear of y<sup>e</sup> Sun. But In More tollerable termes, lett us Suppose, a Cubick foot, & a Cubick Inch, forbear Comparison 1. what Can be sayd of one that is Not true of the other? they are In Every Respect, barring Comparison's, the same thing, ~~and have~~ as to all y<sup>e</sup> property's and Conclusi= on's that Can be p<sup>r</sup>dicated of any Stated Quan= tity of that forme.

But the practice of y<sup>e</sup> World is, to Reduce things to the standard of some agreed dimensions, whereby divers dimensions are Esteemed, and denominatd. as miles, furlongs, Rodes, paces feet & Inches. wee know these Not from any  
Idea

Idea wee have of any Magnitude, but from  
Supposition of some what given, be it More or  
less, other things are In their Ration to that  
declared.

And It is pleasant to observe, that the Mea=  
sure, w<sup>ch</sup> all men assume to gage Every thing  
by, is their owne person's or body's. for If any  
thing vastly Exceeds that, wee call it vastly  
great, and sometimes doe almost beleev such  
Greatness cannot be. So If any thing be So Small  
that wee can scarce discerne it, wee thinck  
such litleness can harldy Subsist in Nature.  
whereas In truth; y<sup>e</sup> least thing wee can per=  
ceiv, Nay (If I may here So Speak) Infinitely  
less, hath all the property's of substance with  
the Greatest. It is from Hence, that children thinck  
places and things great, w<sup>ch</sup> men & weomen thinck  
less, and even so themselves when growne up,  
as wee all know; And without Standing Measures  
Wee Should Never agree about Magnitude.  
A More Notable thing is that Children, and Small  
animalls thinck Even time longer, then Great  
ones. for time is measured by Space, w<sup>ch</sup> to  
them is so, as may be Remebred when I  
speak of time. .or rather

## 17. Devisiōn.

Or rather devisibility, w<sup>ch</sup> wee Conceiv, in Nature possible to be persued ad Infinitum. This is Included in y<sup>e</sup> very Notion of Quantity, or space; w<sup>ch</sup>. If any thing however litle, hath halves, Quarters. &c<sup>e</sup>. It is Not Materiall to this point, whither any pratiq power Can so Work upon any Given Substance; ~~that~~ ffor it is devisible, tho Not devided. and the word devisible hath a double Relation, /to\ the subject, and /to\ the power, w<sup>ch</sup> doe Not destroy Each other. as the Subject is devisible, tho all Naturall power is Insufficient to doe it. It is Enough that all proportion's & Ration's are Included, in Every Quantity, as the head of Minerva In Every block,<sup>382</sup> to appear If superfluity's were pared off; And So an hors May be a good padd, tho None rides him.

But I must Crave leave to advance farther, & that is, /In\ affirming body Not onely to be capable of all degrees of smallness, without limitts, but also that It is actuall Such<sup>383</sup> Intersperst about In the world. I mean that No Quantity or Space can be assigned so small, but there are body's or parts, yet less, ready to fill them. This I Shall call actuall Infinity, and Serve my Self of y<sup>e</sup> Notion, In maintaining plenitude, Not Inconsistent, as some fancy with Motion. And so perhaps, prove it to be so, I'me sure None Can prove its Negative.  
supposing

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<sup>382</sup> The specific allusion here still not found.

<sup>383</sup> It may be that a word has been scraped out here and replaced with 'Such'



## 19. Figure.

Wee have spoke onely of y<sup>e</sup> figure of finite bodys  
 Considered apart, W<sup>ch</sup>, If y<sup>e</sup> Substance Included can /as wax\  
 comply may be varied ad Infinitum, And the  
 Content /or substance Still\ Remain y<sup>e</sup> Same. The same /like\  
 holds of Con=  
 Glomerate lumps of body's. And to say truth wee  
 are not assured wee know any body in y<sup>e</sup> World  
 that is Not such. ffor w<sup>ch</sup> reason, I must declare  
 that most of our discours is of thing's, In Na=  
 ture, possible & supposed, more then of things  
 reall as they are taken to be, but Nevertheless true  
 as Mathematitians prove, then If Experimented  
 upon the things themselves, If any such Exactly  
 were Exhibited. Now to Extend this speculation of  
 figure, wee may Suppose finite Number /of bodys\  
 as well as finite Quantity /Substance\  
 the latter is Either one, or rather  
 divers body's close compact. the other of divers  
 separatd from Each other /and considered together\  
 the former I Shall call a Compact systeme of body & y<sup>e</sup> other a  
 devided systeme.

~~The whole world Infinite as It is, Is but a Com=  
 pact Systeme~~

The world is but a Systeme of divers body's In=  
 finite in Extent & Number; out of w<sup>ch</sup> you may  
 select any parcell ad libitum, to Reflect on  
 & call it a devided systeme; such as the Sun  
 and his attendance of planet's is. or In less  
 compass

20.

## Figure

compass; a Geomantick sceme, Dice cast upon a table, or y<sup>e</sup> Spotts on those Dice: Whenever wee conceiv such devided things together, as any way Related In our Imagination; ~~that~~ It is done under some figure, as well of Each particular, as of all taken together. W<sup>ch</sup> figure Consisting but In Space /or distance\ of part's or points Extended various way's, hath all property's of figure and is Every way Compatable as space or Quantity it self. So there as /are stated\ figures of devided Systemes /of bodys\ as well as ~~compact-systemes~~, /single\ of bodys. And this Relation in our Minds, is Nothing in the body's themselves, unless they touch; for one body is No More affected With or united to another at a foot, then at a yard distance. As when wee conceiv a Constellation, w<sup>ch</sup> is bound up in a feigned Image of a beast &c<sup>e</sup>. The Starr's ~~fell~~ feel it Not, but are unconcerned. And so when wee observe aspect's, w<sup>ch</sup> ~~is a~~ /are\ Configurations, of y<sup>e</sup> planets, it is but a concept in us, to tye them together In any Relation of Effect, or otherwise the planet's are free from all such Engagem<sup>t</sup>. But yet this Imaginary figure Composed in our minds, that is Regarding divers body's with Some comon ~~Respects~~ /Regards w<sup>ch</sup>\ will be of Great use, In the /process of\ Investigating the Nature of Motion  
Is taken

Instances of Confused perceptions.<sup>384</sup>

1. Touch is y<sup>e</sup> Grossest means of sence. and how Nicely will some distinguish wood Stone, mettalls, and (as hath bin affirmed) Even Colours by y<sup>e</sup> touch. the Judgm<sup>t</sup> is Not of thing's but differences, None can describe y<sup>e</sup> texture of what he feels, & yet can tell if it be wood or Stone.

2. Sight is very Nice, and ffrom certein differences of thing's unknowne, wee give Names, as blew, Green yellow. &c. And In some Cases with help of Glasses Wee can discerne the minutes y<sup>t</sup> Compose those Coleurs, as frequent & very small speck's of white upon a black Ground, make's an appearance of blew, & such is y<sup>e</sup> azure sky; w<sup>ch</sup> by Increasing y<sup>e</sup> White Shade's at length in to that, & contrarily Into black. So painters know how to produce Many varieties by mixtures, w<sup>ch</sup> appear & Might be thought simple if y<sup>e</sup> Composition were Not knowne. there is a Mixture called changeble, w<sup>ch</sup> varieth according to posture, as In silks & Ribbons, w<sup>ch</sup> ~~by Glasses is~~ /manifestly\ found ~~to~~ proceed/s\ from y<sup>e</sup> texture, whereof some thredds are exposed Exposed to view, or Not, as it is p<sup>r</sup>sented

3. This is very Manifest also in audibles, as Sounds w<sup>ch</sup> tho seeming uninterrupted or Continued like y<sup>e</sup> path of a Moving body, yet is found to be Composed of distinct strokes or pulses upon y<sup>e</sup> organ of Sence and Every variety in y<sup>e</sup> like Manner or Measure of those

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<sup>384</sup> Although this appears plausibly to be the beginning of a new essay, the next page is numbered 4.



These pulses, affects the sence, altho that knoweth  
 Nothing of y<sup>e</sup> Item's or Mean's from whence such  
 Image or Sensation proceeds. So as In other like Cases,  
 wee fall to give names of these variety's, as unisons  
 3<sup>ds</sup>. 5<sup>ts</sup>. &c. all y<sup>e</sup> are but different Manners of  
 touching y<sup>e</sup> organ of hearing; yet that is So Nice  
 (as is well knowne to accustomed Ears) that a varia=  
 tion In time or Manner of these pulses, cannot  
 scarce be So Inconsiderable, but y<sup>e</sup> Mind is affected  
 and takes it.

The Caus of Indistinction  
 of Images.

In visibles I touch't before, and ascribing it to the  
 medium, w<sup>ch</sup> doth actually blend y<sup>e</sup> Ray's before  
 they Come to y<sup>e</sup> Eye; whither this be in y<sup>e</sup> air or  
 In y<sup>e</sup> humours of y<sup>e</sup> Eye, Matter's Not. y<sup>e</sup> latter is  
 manifestly some caus, If Not y<sup>e</sup> cheif. ffor wee find  
 y<sup>e</sup> power of sight in divers persons so various, Some  
 seeing, & others not discerning small thing's, and  
 all helpt by Glasses, tho deminishing, becaus they  
 Renew y<sup>e</sup> object neer y<sup>e</sup> Eye, that wee have reason  
 to conclude the Mind hath a true Image of visi=  
 ble of object's as they are Immediately p<sup>r</sup>sented  
 And

The Nicety of sence,<sup>385</sup>

Wee say that our Sences are limited, so as beyond y<sup>e</sup> ordinary bounds, either in y<sup>e</sup> way of Greatness. or litleness, wee have No capacity. As to y<sup>e</sup> former if an Impression riseth to violence, the texture of y<sup>e</sup> organ may not be of a firmeness or texture to bear it, but as all wo/u\nding, such tends to destruction, & is painefull therefore perceived with a wittness. And thing's so great as y<sup>e</sup> Earth & planets, wee cannot Examine, becaus wee cannot take them before our faces, to Make any Impression. ffor what toucheth us Not, is as If it were not in rerum Natura.<sup>386</sup> So that it is Not so Much Want of capacity, as the magnitude of our body's, that Re= moves us from all possibility of Implying our Sences about very great thing's. therefore as to them wee goe to work with comparison's & arguments, More then by actuall /Immediate\ sence. But In y<sup>e</sup> way of litleness, It seems' that y<sup>e</sup> Capacity of o<sup>r</sup> Sences, are /is\ No More limi= ted then, the ambient Matter is; and If that be Infinitely small, y<sup>e</sup> sence must be infinitely Nice. ffor Since it is Granted, that our perception's are but Notices of Matter moved, I see No reason to bound y<sup>e</sup> Capacity of y<sup>e</sup> one then the Magnitude of y<sup>e</sup> other. but Shall Suppoe that part of our body's where the superior tendency of the minde Resides is perceivable, or rather actually per= ceived; And the caus of having No Regard to Small things, I Shall Consider when I come to speak of attention, w<sup>ch</sup> is an act of y<sup>e</sup> Mind or Will, & Not of y<sup>e</sup> perceptive faculty.

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<sup>385</sup> This page does not follow on from the previous one, although it develops a similar topic.

<sup>386</sup> i.e., 'in the natural world'

## Objects distinct or Confused

The Sensible world, however ~~it~~ /otherwise things\ appear to us, is composed of parts, & systemes, or combinations of parts, and altho all diversification's of them, vary the Idea or Image wee have of y<sup>e</sup> whole, yet wee cannot always distinguish y<sup>e</sup> Manner or Item's of that change no More, then wee can distinguish the Minute parts of w<sup>ch</sup> any thing is Composed. from whence it happen's that the Idea In y<sup>e</sup> Mind, vary's Much from the thing perceived, ffor that is of part's devided & distinct y<sup>e</sup> other is of a confusion, or y<sup>e</sup> Same thing without distinction of parts. And the ascribing the Image in, y<sup>e</sup> Mind, to thing's perceived, as it Were really subsisting In them, is y<sup>e</sup> Caus of Most vulgar Errors. Now this blending of thing's or Confusion, of w<sup>ch</sup> y<sup>e</sup> sence takes an Idea, w<sup>ch</sup> is not Elsewhere but in y<sup>e</sup> Mind onely, argues No defect in y<sup>e</sup> Capacity of sence becaus y<sup>e</sup> least change Even iff y<sup>t</sup> confusion is discerned. but it argues that y<sup>e</sup> Impression's w<sup>ch</sup> come's from y<sup>e</sup> /severall parts of\ object ~~is~~-/are\ conveyed by some Irregular Mean's, wherein, the distinction of Each Impuls is Not conserved, but Crossed or Mixt together, so that y<sup>e</sup> Mind takes y<sup>e</sup> Image according as it arrives confused or Mixt, but looeth None, Nor overlooks alteration's, if any be. or Els that Some what hinders y<sup>e</sup> attention ~~to~~ w<sup>ch</sup> Should make a distinction. I shall subjoyne some Instances under this head.

---

<sup>387</sup> '298' in pencil, crossed out. It is likely these fragments were origined and subsequently reorganised all at once

## philosophy=&amp;-fers

philosofers are as Much a subject as the Subject  
of their learning; It is a strang diseases, to search how  
by wisdom, that is knowledg of truth, and doe it by  
Not by gathering from y<sup>e</sup> experience, y<sup>t</sup> is /from\ the wrighting  
of /all\ others Indifferently, and their owne sense, taking the  
just, & Repudiating the faulty, but by Contradicting the  
most Eminent, as If by kiek kicking downe one Man's  
fabrick our owne was raised; by pulling downe a  
Neighbours high hous our owne was made higher. so it  
was that Aristotle composed his phisicks, Not after his  
owne Mind & understanding, but to vary from the Sects  
the Regnant, and y<sup>e</sup> World being fond of cleaver Con=  
trivances, or whims of words, those p<sup>r</sup>vailed in the  
place of things. And Now it is a Mode to Confute  
Cartesius, as it was heretofore to Confute bellarmine<sup>388</sup>  
as if phisicks were like Religion sacred & of faith ra=  
ther then humane experience. Who is there that writes  
but Mallents cartesius, and those they Call his followers,  
and In just such an Insulting style, as a preacher  
treat's a Mighty heretick. Wallis the Mathematitian  
stuff's a page or two with a puerile designe to per=  
swade that Cartes had his Conduct of an Equation's  
from heriot, & all becausa a frenchman said il y a veu  
and doth him so litle right for so great an Inventor  
In Geometry, as scarce to Mention him Civilly.<sup>389</sup> then M<sup>r</sup>  
Newton's whole designe is to discredit Cartes systeme  
of y<sup>e</sup> world. In solving y<sup>e</sup> planet's courses, &c. all w<sup>ch</sup> puts  
me in Mind of a ~~childs~~ children's heraldry upon  
Nutts w<sup>ch</sup> are made to fight till one side falls. and they  
account If a nut cracks another w<sup>ch</sup> hath Crack't 19. that  
hath y<sup>e</sup> hon<sup>r</sup> of cracking. 20.<sup>390</sup> so if Ever it is with y<sup>e</sup> lea=  
ned in their opinions. si serpens serpentum comedant fit draco<sup>391</sup>

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<sup>388</sup> Roberto Francesco Romolo Bellarmino, S.J.(1542-1621), a counter-reformation theologian and churchman, one of Giordano Bruno's judges.

<sup>389</sup> see note on f. 213v

<sup>390</sup> This is the first side of a folio folded into two (a technique frequently employed by RN), the other three sides are unmarked (in the BM numbering, the second sheet is unnumbered). The children are playing conkers with horse chestnuts. When one conker cracks another it becomes a 'oner', and so on. If a conker cracks a conker that already has a score, it assumes those honours as its own; thus if a fiver beats a sixer, it becomes an elevener. Thus if you beat a nineteener, you become a twentier.

<sup>391</sup> 'Serpens nisi serpentum comderit non fit draco' (A serpent must have eaten another serpent before he become a dragon) quoted from Francis Bacon's Essay XL, Of Fortune.

300v

<page blank>

unnumbered r

<page blank>

unnumbered v

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Upon a Cursory perusal of the Easy Method /Etc,<sup>392</sup> I observe.

1. That the sceme hath hath Not that Simplicity as one would desire, ffor it is Restricted to certain starrs, whereof the declinations, & R. Asc. are to be considered, as also the latitude of y<sup>e</sup> place with Respect to them. Whereas In y<sup>e</sup> papers you have, there is but one starr to be used w<sup>ch</sup> for y<sup>e</sup> Service of the whole world; and without Regard to any Stellary R. asc. declinations, or latitudes of places depending thereon.

2. He sets his Saylor to work /at first\ by Calculation of Right Ascensions, to find his southing at london; w<sup>ch</sup> single operation is obnoxious to Error divers way's, and is better Retrencht, If it may be, and that is done in the same papers, by giving the southing tabulated to. ho.<sup>393</sup> 1. 0<sup>i</sup>.0<sup>ii</sup>.0<sup>iii</sup>. &c with y<sup>e</sup> utmost Nicety Astronomy can p<sup>r</sup> tend too.

3. He recommends divers tables, wch are Effete & useless from Effluxion of time  
since

---

<sup>392</sup> This letter makes constant reference not to a book, but to papers. It seems to have been written quickly after a hurried exposure to the text (see note below, f. 302v). In terms of the content discussed in the letter, it can only have been written in relation to Charles Hayes, *A New and Easy Method To find the Longitude at Land or Sea*, published anonymously in London by D. Midwinter, 1710. The preface to that book is as follows: "To The Reader. The Author of this ESSAY having had the misfortune to lose his Original Manuscript above a Year since, did again, about two Months past, digest his Thoughts in the following Order; which now he thinks himself obliged to Publish in a more hasty manner then otherwise he intended to have done; Because that on Friday last the 23d of this Instant June, he was inform'd That on Wednesday the 21st of the same Month, Mr Keith had presented a Paper to the Royal Society, at Gresham College, about Longitude: And having thereupon procured a sight of the said Paper, and finding some things therein agreeing with some of the following Notions; the Author hereof did, the Same Day, viz. the 23d Instant, about two Hours after he has seen the said Paper, shew the Copy, from which the following Sheets are printed verbatim, to a Person of Great Worth and Learning; who was thereupon pleased to peruse the said Copy, and to seal and subscribe the same, that no Alteration might be made therein; And the same Day the Author gave Order for the Printing It: Which is done, not with design to detract from any Merit which may be due to Mr. Keith's Performance, but onely to prevent the said Mr. Keith's entertaining any Thoughts that the Author hereof has borrow'd any thing of him. London, June 26, 1710. ADVERTISEMENT. This ESSAY will very speedily be Publish'd in Latin, French and Dutch." This raises the question, is it possible that RN was the worthy learned person looking at an draft of the book? I would say so, which would make this one of the few securely dateable manuscripts in the volume. He would likely have known who Hayes was on account of his *Treatise on Fluxions*, 1704, which tested and proved Newton's calculus, but he does not recognise the author here - who by his own account brought the papers to RN's door in person. [This is a fascinating episode in the history of panics to establish ownership of ideas, etc. etc. {Alfred Wallace/Charles Darwin} and bang on time for the copyright laws - I wish I'd known of this when writing about RN and the public sphere]. The first book published in English with 'easy method' in its title was in 1640, a translation of a French book; from c.1700 publication of books with such titles comes in a flood, offering all sorts of immediate gratification and achievement.

<sup>393</sup> i.e., 'hour'



since they were made, and need (as some have) tables on purpose to Regulate the Errors; w<sup>ch</sup> Considerations Confounds the designe, that<sup>394</sup> must work with y<sup>e</sup> least possible error; ffor what is Small in the Obs:, is great in y<sup>e</sup> Long. And the tables by your papers proposed, are to be made Express, and the cheif to be Renewed Every year, and (as may be) oftener [Exam<sup>d</sup>?], and the others /devised\ that is y<sup>e</sup> long: and, Comeridi= an starrs. once made last for Ever.

4. He has take no Consideration of the Anomala of the Heaven's, w<sup>ch</sup> makes a frequent Review of y<sup>e</sup> foundation table Necessary; as you have /In y<sup>e</sup> papers\ Noted /vist\ y<sup>e</sup> p<sup>r</sup>cession, and the polar variation.

5. His methods /of\ observation are proper for y<sup>e</sup> land, but will Not doe at sea, with the needfull Exactness; for what can anyone make of an Astrolabe or Crosstaff in very bad weather: and besides finding y<sup>e</sup> greatest Altitude doth Not find y<sup>e</sup> meridian, becaus of the Stellistice. The compass, or plum will come nearer, and y<sup>e</sup> medium be a better Expedient, as I have proposed.

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<sup>394</sup> A word has been scratched out and 'that' inserted in its place.

6. And after all His sceme is not just, for there is Not given a just, Now, into y<sup>e</sup> Space of 24. hours. ffor supposing y<sup>e</sup> tables of y<sup>e</sup> suns. R. asc. true. they are Calculated to y<sup>e</sup> days of y<sup>e</sup> year. vist<sup>t</sup>, at 12. night. all the rest of y<sup>e</sup> day, hath No. acc<sup>o</sup>. If an obs. is taken at 11<sup>o</sup>.59'. ho. Night and another at. 1. min past. 12. between those obs. there is but. 2. min. difference, but by y<sup>e</sup> table y<sup>e</sup> longitude run, Shall be near a degree, or about 50, Geographical miles /error\ So the tables of the. S. R<sup>t</sup>. asc. will Not doe, unless Calculated to ho. &. min. as well as days, w<sup>ch</sup> is not to be done, & If it were done, **tale quale**,<sup>395</sup> would Not hold at all, Whereas y<sup>e</sup> Southing of a Single starr is to be calculated, to /but\ one moment in Each day, vist<sup>t</sup>, y<sup>e</sup> Coming to South, w<sup>ch</sup> may be Exact to all possible nicety /as of ho. 0<sup>i</sup> 0<sup>ii</sup> 0<sup>iii</sup> 0<sup>iiii</sup> &c.\; and leavs Nothing to be done at sea but finding y<sup>e</sup> true Southing of that starr, and It is hard If y<sup>e</sup> Saylor will Not undertake that.

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<sup>395</sup> i.e., 'as it is', 'in this form', or 'as such'

Longitude<sup>396</sup>

These are the *Adversaria* /points<sup>397</sup>\ Whereon wee vary, Now as to our agreem<sup>ts</sup>.

1. The Canon of time, giving y<sup>e</sup> long. that is y<sup>e</sup> Invention of Neither of us, but a comon Notion in Cosmography.

2. The use of the watch for y<sup>e</sup> dependance, byut, my way holds it Not so long, as his, ffor y<sup>e</sup> work may at any time be dispacht in and hour within Night.

3. The plum, as he proposeth it, it is Not for y<sup>e</sup> Sea to be Hung up, for y<sup>e</sup> Motion of the vessell spoils all, and at land it is No other then is in comon books of dialling to find a meridian line.

4. But for Rejecting all planetary helps wee both agree, that is In Holding onely to observe y<sup>e</sup> fixt starrs, and So farr I can onely say wee have y<sup>e</sup> Same thought, but yet It is to be Insisted that y<sup>e</sup> application to practise is y<sup>e</sup> Invention, & so y<sup>e</sup> act of [partt?] declares.<sup>398</sup>

Lastly I alledg Not ought here to depretiate these papers, w<sup>ch</sup> I allow to be from an astro=  
nomick genius, and profess very ffair /but to maintain my owne point\. and I Should be gladd (If I might be so happy,) to Injoy a litle conversation with y<sup>e</sup> author

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<sup>396</sup> The word 'longitude' written at the top LHS of the page; not so much a marginalia as a note

<sup>397</sup> The word 'points' added, apparently not in RN's hand.

<sup>398</sup> marg.: 'This is all my time allows to be observed in these papers you were so kind to send me.'

## Heads

Introduction, waiving  
any description. &c -  
>  
comparison of y<sup>e</sup> baras=  
cope with a Comon lever

Add somewhat of y<sup>e</sup>  
designe, touching y<sup>e</sup> severall  
Incident subjects, to be  
discourst

Of y<sup>e</sup> air, In generall.  
penumbra in Eclipses  
Refractions.  
In particular.

( Add. a [2<sup>d</sup>?] head. The  
-( substance, water.and  
( y<sup>e</sup> originall

Grossness	)	
extendible, &c	)	
Compressible	)	These Should be ab=
Spring	)	breviated as Much as
comon air prest	)	) may be.
That by weight	)	
Ether Intermixt	)	)
Rarefaction proved ex=	)	
clusive of annihilation	)	)

Is water Evaporated  
proved by conformity  
to experim<sup>t</sup>.

<sup>400</sup>History of y<sup>e</sup> Green wax  
[Pject?] - - 223  
Some Reports

---

<sup>399</sup> The folio is folded so that it can be written on in two columns (the layout is imitated here and on the verso). This side was written first. The folio was subsequently used for a rough and ready index of the Life of Francis North (that is a provisional guess, haven't checked). Overleaf can therefore be dated to the early-mid 1710s, this side therefore earlier (duh).

<sup>400</sup> The last two paragraphs crossed by a diagonal line. The second part of the last 'paragraph' (beginning 'History') is not part of the 'Heads' on this side of the sheet, but a continuation of the list of items overleaf (see over)

History of faction  
 [tp.?] car. 2. - - 1.  
 Notes of Chancery  
 cases - - - - 41.  
 Admiss<sup>n</sup> S<sup>r</sup> Rob. Saw=  
 yer speaker - - 72.  
 Discours of the  
 Chancery - - - -73.  
 - Abuses - - - -81.  
 p<sup>r</sup>parations for a  
 book of orders - 82.  
 memoirs Concerning  
 trade - - - 95.  
 Memoires historicall. 99.  
 of the Study of y<sup>e</sup> law. 103  
 Directions for practis 105.  
 Recoverys of Inf<sup>ls</sup>. 106.  
 Essay of Ireland. 112  
 Visitations .second 104  
 protectio Regia - - 109  
 Councill del Roy  
 In part - - - 109  
 Collect<sup>ns</sup> about going  
 beyond sea 105.  
 Right to ways - - 106  
 comittm<sup>ts</sup> by parlt  
 & Hab. Corp - - 106  
 [of?] B.R. & C.B. - 110

order, about [capras?] 116.  
 view of p<sup>r</sup>sidents of  
 Recovery's by Infants ... 117.  
 of Scotland - - - 117  
 concerning Scotland 118.  
 Reflections on y<sup>e</sup> Quo. Warr. 119.  
     cases of Judicature in  
 parlt - - - -124.  
 [Fitcham's?] case. q [Reply?]. 126  
 Speech to y<sup>e</sup> [Serg<sup>ts</sup>?] - - 127  
 Rules found in [...?]. 129  
 Gen<sup>l</sup> Consid: In [...?]  
     & B - - - 130  
 of y<sup>e</sup> D. Norfolks Case - 132  
 [...?] v<sup>s</sup> Ep. Ely - - 135  
 [D..?] Rex, v<sup>s</sup> Holles & al. 140  
     case of S<sup>r</sup> Hen North  
 of Mildenhall . . . 145  
     case of Hyde & Emerton . 150  
     letter to y<sup>e</sup> Judges about  
 certifying prisoners ... 169  
 Carter. v<sup>s</sup>. Crawley - - 170  
 Thomas. v<sup>s</sup> . Sorrell - - 178  
     Murrey v<sup>s</sup> Eaton - - - 191  
 case of y<sup>e</sup> law patent 205  
 cooly v<sup>s</sup>. Jemot - - - 213  
 /[...] \Jacksons case - - 221  
 of y<sup>e</sup> Greenwax - - - 221  
     law Revenue \_ 223.

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<sup>401</sup> List of items and page numbers relating to career of Francis North? This is clearly the final use of this sheet, this side has lain face up on top of a pile, as evidenced a dust shadow. Sheet ff. 306/7 probably sat on top of this, the 'shadow' fits. The list above is part of the fuller, though presumably earlier, contents list of the 'tomes' on f305v-306r (these elements under specifically '2 History' on f306v, below).

304r<sup>402</sup>

~~pauls~~

Bernard Coach=  
Makers

Jul. 1707

<flourish underline>

<mathematical/geometrical drawing in pencil>

---

<sup>402</sup> The next two folios have been folded a number of times, vertically and horizontally, as if they were to be carried around. The crossed-out word 'pauls' at the top of this page refers to the image on the verso, and the related image on the recto of the following folio. There is a clear trace of the pen/ink used by Joseph Bernard to sign the receipt on the verso of the next folio at the top RHS of the sheet (was he offered the same pen and ink as used for the drawings? most likely). Joseph Bernard was Master of The Worshipful Company of Coach Makers and Coach Harness Makers in 1716. Chances are that the sheets, now separated, might previously have been joined - note the discolouration of the paper overleaf at the lower RHS and lower LHS of the two facing images of St Pauls. The x-section overleaf is obviously related to circulating print images of the structure of the dome which trace the successive designs proposed by Wren whoi was still at work on the project. Although the drawings could be from any time before July 1707, there is a possibility that the drawings and the use of the paper as a receipt indicate that they were contemporary. RN has documented a number of visits to the site of St Pauls in 'Notes of Me' and several essays (see also his 'Notes on Architecture') which granted him privileged access to the site and the architect in the 1680s. [Check out progress on dome by 1707, x-reference alo the 'Notes on Architecture']. The profile of the ink-drawing for the cross-section of St Pauls overleaf has been traced in pencil on this sheet, and a demonstration of a mathematical/geometrical point has been made from that curve. An indistinct word, in pencil (upside down as the page is now displayed), is part of this addition. Most of RN's more 'finished' pen-drawings and diagrams are begun with a pencil sketch.

304v

<diagram: in ink; x-section of St Paul's Cathedral, dome and drum, showing the 'catenary curve' solution to the inner dome; horizontal dotted lines aligning it to the diagram/drawing on the following sheet. Note how the RHS of the drawing is out of scale with the RHS, the dotted horizontal lines link the two drawings, but do not integrate the elements of this one drawing!>

305r

<diagram: In ink; exterior of St Paul's Cathedral, dome and drum; horizontal dotted lines aligning it to the diagram/drawing on the previous sheet>



305v<sup>403</sup>

[?] July 1707,

Rec<sup>d</sup> In full for a  
sett of 4. harness and  
topps, and all demands  
by me

Joseph Bernard

---

<sup>403</sup> The receipt is clumsily written in another hand (Joseph Bernard's ...). What sum received was, is not mentioned. Note, also, a spill of fluid, perhaps ink, perhaps not.

tomes.		Memdum these to be transcribed verbatim
1	Incidents. )	In these tomes.
3.	passages ) 1. tome.	
2.	Ministry )	
<hr/>		
1	benefactions )	
2	Accusations )	
3	Slanders ) 2. tome	
4	Retiredm <sup>ts</sup> . )	
5.	Characters	
<hr/>		
1	parlim' <sup>t</sup> )	
2	Regulations )	
q	(- com pleas )	
	(- chancery ) . 3 tome	
3	franchises )	
4	fforrests )	
<hr/>		
1	Match )	
2	p <sup>r</sup> ferrm <sup>ts</sup> )	
3	Contemporarys )	
4	Trade ) 4 tome.	
5	Ingenuitys )	
6	Wrightings )	
	Miscellanes.	

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<sup>404</sup> The material referred to on this and the next page are to be found in BL Add MSS 32518-20; additional material on Francis North's legal career in BL Add MS 32521 & 32523. Mary Chan, *The Life of the Lord Keeper North by Roger North*, The Edwin Mellen Press, Lewiston, Studies in British History, Volume 41, 1995, pp. xii-xxiv, lists six versions by RN of the text of the biography, to which geology this list belongs. Her book is a transcription of the last version of the text, James MS 613, St. John's College, Cambridge.

	of Incestuous Marr <sup>o</sup> [..?]
	<del>of a Registry</del> - - -
2 History.	6. Arguments.
1 of parliments. - - - 19.	Dn's Rex v <sup>s</sup> Hollis . 140.
2 Main lines of history. [mh?] <sup>405</sup>	[ffoy?]. v <sup>e</sup> Ep. Ely - - - 136
3 Some notes from y <sup>e</sup> parly	Case de Mildenhall. 145
Rools. 1661. - - - [oh 2?]	Carter v <sup>s</sup> Crawly . 170
4 Memoires Historicall. 99	Murrey v <sup>s</sup> . Eaton. 192.
5 History of faction . . 1.	soam v <sup>s</sup> Bernbardis=
History of the Green=	= son - - - -
6 wax project - - - 223	Hyde v <sup>s</sup> Emerton. 158
	of the law patent. 205
5. law	Thomas v <sup>s</sup> Sórrell . 178
2 Discours of high treason	Case of y <sup>e</sup> law pat. 205
1 View of Judicatures. [gf]	cooly & [Jemotts?]. 213
3. Exclusions & pardons. [id?]	
4. Comittm <sup>ts</sup> & Hab. Cor. 106	7. Reports
<del>of the com. pleas</del> 129	
9. General Registry:	In the circuits
<del>of the Chancery.</del>	Speciall law Cases.
8 D of Norfolks Case. 132	<del>In the chancery.</del>
5. of Corporations .. [uh?]	Cases in Equity
6. of Election of Sherriffs [yh?]	
7 Reflection's on y <sup>e</sup> Quo Warr. 119	

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<sup>405</sup> Some of the 'page references' are not clear - neither legible nor comprehensible. See note to previous page.

1 State.

of the Eng. Monarchy. [oc.?  
 /Methods of faction.\  
 Essay of Sedition . . 11.  
 of Ireland - - - - -  
~~of the mint~~  
 Essay on ye E. India  
 company . . . . 21.  
 The Kings Revenue  
 by ye law, & [frauds?] in  
~~other Branches.~~  
 frauds to ye crown.

4 Speeches.

charges In Circuits [..?]  
 At ye opening of the  
 parl't p<sup>r</sup>pared - - - 99  
 Tryall of ye [p..?] - - ab.  
 Installing Sanders  
 Ch. Just - - - -  
 At p<sup>r</sup>senting Sr Rob<sup>t</sup>  
 Sawyer speaker . . 72  
 At a [Call?] of Serg<sup>ts</sup> - - 127  
 To the lord Mayor  
 & citizens of london.

~~3. Regulations~~

~~of the Com-pleas  
 of the Chancery  
 of a Registry.~~

Trade.  
 of ye mint & coynage.  
 of the. E. Ind Comp<sup>a</sup>.

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<sup>406</sup> See notes to previous two pages.

dispatch of|<sup>407</sup>buisness & suiters  
 Sr. Sam<sup>l</sup> Morland  
 x Coffee hou|ses  
 Divers Tryalls,  
 Etheredg Sr G.  
 Table of |news for lys.  
 wondered a|t folks credulity  
 x pamphlet| ag<sup>t</sup> pamphlett  
 dispatch |of Causes  
  
 not dy but demise.

---

<sup>407</sup> See notes to previous three pages. A number of vertical lines , more or less vertically aligned, inserted at these points - it is not clear that they 'belong' to this page, as they may be the result of another operation ... there are a number of geometrical looking lines on the lower RHS of the sheet that look as if they might have soaked through another sheet, set on top of this one, being used for calculations.

## Index Emendatrix

- A occasion, from y<sup>e</sup> old Ignorance of phi= losofers, who had y<sup>e</sup> Same Notions as y<sup>e</sup> vulgar. language is wanted for y<sup>e</sup> Subject proper. Cartesius y<sup>e</sup> first disco= coverer of this terra Incog.
- D. The thought's of Car= tesius of Motion. Not so Explicite in his books & why.
- H. His failing.
- I. M<sup>r</sup>. Newton differs, In motion absolute. [pardies?]. In vacuo.
- K. Both Mistaken,
- L. motion is Subject to the same Rules In plano as In vacuo
- N. comparison of M<sup>r</sup> Newton's, & Cart<sup>s</sup>. meth.
- M. Cartes ill used
- R. Mathematick Method not proper in phisicks but what depend on quantum.
- S. All our perception from motion. complicate effect's Not Examinable onely simple
- V. thence y<sup>e</sup> law &c.
- W. The use if Imagination Method of Proceeding.

- D. Mundane Systeme not to be proved
- W. Mathematically
- X. All Modes of body
- Y. not inconsistent with Impenetrability may be true, are as such supposed
- Z. How body May be changed.
- A.a. Of Springyness
- A.b. Chang by Mo= ving.
  1. posture - [...?]
  2. distance prog.
- A.c. Difference in speaking of time and of velocity
- A.d How movem<sup>ts</sup> are judged.
- Ae. Body's Meeting Must pass
- Af. With Same Speed motion Not greater.
- A.h How /Ag.\ body's may either be moving or Resting.
- Ak Instances of de= vious p<sup>r</sup>judices
- Ai. Apt to ascribe y<sup>e</sup> movem<sup>t</sup>, to y<sup>e</sup> least & Not to y<sup>e</sup> most.

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<page blank>

Ayre.

1-

Amongst all the Complexity's the theory of y<sup>e</sup> ayre is to us Most Important and yet, tho wee breath it, least understood, and had it Not bin for the torri-cellian Experiment, and the observation's of latter date drawne from it, I might Say, with confidence, Not understood at all; but that Experiment prosecuted by Mr Boyles air-pump,<sup>409</sup> hath disclosed an Indies of Naturall Riches, of w<sup>ch</sup> No Grain /Scrupule\ Ever had place In y<sup>e</sup> brain of man before. I shall not give an history of these discovery's, w<sup>ch</sup> is to be found In the bookes of the vertuosi, but draw my thred thro the matter, Shewing, If I can, that all the phenomena of it, are Resolved without aid of any other principles, then wee have already proposed.

That y<sup>e</sup> air Is a fluid body is Not Questioned, but Not Such as Water, or What wee Call liquor; ffor those generally, and most particularly water, are Incompressible; and Engineer's find that a mountaine will blow up, sooner then water Quitt his room, by, being Inclosed, like Case hardned Steel, Resist's all force, and will burst any thing, before it yeilds. But Air yeilds More or less to Every fore, Inclose it and it may be compressed Into 1/10 of y<sup>e</sup> Space; and If /as much\ more room be given it, It will seem to Expand it self In to /it\ all. ~~much more~~ And If warmth be applied It will stretch, and If cold Contract. w<sup>ch</sup> they call rarefaction, and Condensation. And this spontaneous

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<sup>408</sup> These pages have been renumbered *twice*, the renumbered pages run through to the end of this essay - which is up to the end of this volume. RN's own numbering is also struck out on the rectos.

<sup>409</sup> Robert Boyle (1627-91) had first published his findings, following his experiments with the help and advice of Robert Hooke, in *New Experiments Physico-Mechanicall, Touching the Spring of the Air, and its Effects*, London 1660.



Expansion Whither Extraordinarily Comprest or Not Comprest, when room is Made for it, so to doe, gives us the Idea of its spring, w<sup>ch</sup> they Call Elasticity. And there is scarce any occasion for a Spring w<sup>ch</sup> May not be had by Mean's of y<sup>e</sup> air. ffor Even Gunns are con=trived to Receiv a Compressure of air, & by letting it loos to a bullet in a tube, sends it away as by a Strong Explosion. That the air is of a limited height from y<sup>e</sup> Surface of the Earth, & that Not very Much compared with y<sup>e</sup> diameter of y<sup>e</sup> Globe, as also that it Grows thinner & more transparent upwards, & at last shades away without termination, appears by the penumbra In lunar Eclipses. And however being an uniforme fluid, so as one part in like level, can=not, more then water, discover weight, being bal=lanced, and so Easily moved any way, yet means are found by M<sup>r</sup>. Boyle, & other's to prove it is actu=ally heavy, and may be weighed In comon scales. And it is Most apparently true, that it weighs upon its owne mass, so that y<sup>e</sup> lower is in all stages more Comprest then In the higher, and consequently hath more of a Spring. as an heap of wool or curled hair, is looser at y<sup>e</sup> topp then downewards gradually to y<sup>e</sup> bottom, becaus the upper lyeth upon it, & Compres=seth it accordingly; and when y<sup>e</sup> upper is taken away the lower will In manner of a Spring rise up. so the air Never failes when way is made, by creating y<sup>e</sup> torricellian or any vacuity, to crush Into it with  
all

air

3

all y<sup>e</sup> force it hath. and this force happen's to be measured by y<sup>e</sup> Mercury In y<sup>e</sup> Baroscope, as May be Shewed. And that y<sup>e</sup> air hath Much water in it. is abundantly proved by Experiment, ffor cold applyed It will Condense, and Mist's gather in it, w<sup>ch</sup> abroad are clouds, and by rarifying heat y<sup>e</sup> air shall swell. & all y<sup>e</sup> watryness drye up; as will be Shewed when I consider of y<sup>e</sup> baroscope.

But whither y<sup>e</sup> air be w/holly or Most water may be some Question; The moderne vertuosi, who are very apt to run Into Qualtiy's, say there is a substance y<sup>t</sup> is meer air, defecate of all water, w<sup>ch</sup> hath y<sup>e</sup> Springy property. ffor they have way's of taking out y<sup>e</sup> water. As to this If they mean No other then an uniforme fluid that hath No water in it, I doe Not contend, for It May be all water May be drawne from it. tho Even in that they May be mistaken, ffor wee have Not power of cold Intended to Such degree, as Wee have of heat, & Nothing but Cold will take out y<sup>e</sup> water from air, And I am at liberty to Say, totes Quoties,<sup>410</sup> find More Cold & you will have More water. or perhaps, y<sup>t</sup> y<sup>e</sup> Cold is so Intens It hath congealed y<sup>e</sup> watry part's Into Ice. but I Say let that pass; If they mean by air a congeries of corpuscles lying loos, & so becoming fluid, I contend Not ffor gold is Gold, Iron Iron; and (all our fantasmes Removed) Nothing but Modified body's Conglomerated. And so let air be; for I must Not allow any Intrinsic property

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<sup>410</sup> i.e., 'as often as'

property's necessary In air More then in Gold or Iron,  
let them that like em, or can fancy a need of em  
take 'em.

Wee find by Comon Experience, that much of y<sup>e</sup> Surface  
of the Earth, what with culinary fire, & solar heat,  
continually Exhales and turnes into air, and of these  
Of water Much y<sup>e</sup> Greatest part, for a slight heat  
raiseth that, and It must be actuall Culinary fire to  
Macerate Solids and Convert 'em Into air, and wee Can  
perceiv litle Returne to y<sup>e</sup> Surface of y<sup>e</sup> Earth, but What  
comes in y<sup>e</sup> Shape of water, and the signalls of that  
are clouds & vapours. So that Whither y<sup>e</sup> air be a /distinct natured\ body  
as Christall, wood or y<sup>e</sup> like, ~~It~~ or Made up of these  
Exhalations, It is certein that the Exhalation's are  
very much, and have a great Share of places in the  
Atmosphere with it, and It is hard to discover Watry  
air from other, but by Mean's of Cold, w<sup>ch</sup> Makes it preci=  
pitate. These Exhalation's, as I say'd have so great a share  
of place, that if Much My better's In Judgm<sup>t</sup> & Experiment  
had not a fancy to signalize air otherwise I Should  
without hesitation conclude it is Nothing Els but ter=  
rene vapours, and Not such an Elementary Substance  
as they fancy;

As to Vapours, distinguish't from Comon air, [it?] comes  
In My thoughts to observe; that they are more apt  
to Returne to water continually as they are fresh  
Raised. This the Engin for Raising water by fire  
argues

air

5-

Argues that ffor the steam of water is raised & forced Into a vessell close sodred up, Except y<sup>e</sup> due Channells that are managed by stop cocks; and that steam is so compressed & condensed, that the very Spring of it Crowds y<sup>e</sup> water (lett into y<sup>e</sup> vessell before) up a pipe to an Imens height. and then /y<sup>e</sup> air having yet room\ cold water is let fall upon y<sup>e</sup> vessell to cool the air & It shrinks again, by turning to water, & sucks y<sup>e</sup> externall water y<sup>t</sup> is to be Raised In againe & so it works alternatley by sucking & squeeasing. w<sup>ch</sup>, with 2 vessells at work combined, keeps continuall current At the vent aloft. and were not y<sup>e</sup> fabrick of y<sup>e</sup> Engin difficult and the Junctures of the parts very fraile, w<sup>ch</sup> under so vast a force as is made here by onely Rarefaction and Condensation of air, are apt to burst. It were y<sup>e</sup> best engin for raising water, that Ever was Invented.

The whole buissness of distillation is all Experiment of this property of humids, to rise In vapour by heat and being soon Encountered with cold to shrink into liquor again; as who will may observe from the fabrick & use of comon stills, for be they gross, as they call a cold still, or the Alembeck, or worm they all work alike. for y<sup>e</sup> watery materiall is put upon fire, and Cold mettall brought over y<sup>e</sup> vapour, So as y<sup>e</sup> vapour meeting the mettall shoots Into water w<sup>ch</sup> trickling downe is Collected Into vessells. the Alimbeck hath a vessell over y<sup>e</sup> Mettall they call the Refrigeratory, In cold water is kept, to make y<sup>e</sup> vapour Shoot.

&amp;

## 6. air

and the worme is onely a spirall pipe continually /- & equally\  
 In/D\declining for y<sup>e</sup> liquor to run; and /so\ Extending y<sup>e</sup>  
 vapour passing thro it Into length, Cold water covers  
 y<sup>e</sup> worme, and /suddenly cooling\ p<sup>r</sup>cipitates y<sup>e</sup> vapour; by w<sup>ch</sup> they get the  
 liquors as they have /by\ Experimented/ence\ found practicable.  
 Here in all this process. Is Nothing but heat to  
 convert humid matter or liquor Into vapour  
 or air, and Cold, to Make it Returne Into air /water\ a=  
 gaine; w<sup>ch</sup> proves more Effectuall & to yeild More  
 Copiously, as it is taken neer & soon from y<sup>e</sup> Raising  
 ffor If it /once\ Got abroad or had room to Expaliate and  
 Cool by degrees It is Not likely /so\ Much vapour Would  
 have risen. by any mean's come from it; ffor that /action\  
 may p<sup>r</sup>vaile w<sup>ch</sup> they call assimilation, w<sup>ch</sup> is the  
 Water may be more Effectually be turned Into air,  
 Either by being connext to less watery parts, or by  
 being broken Into Smaller parts, by w<sup>ch</sup> mean's It  
 is Most probable, vapour becomes air, and less apt  
 to Returne Into liquor againe. ffor it is Not Inept  
 to be Imagined, that the longer the air continues in  
 y<sup>t</sup> state, by mixing & macerating the watry with y<sup>e</sup>  
 Dry parts, there may be such union's made, as to  
 Effect what they call assimilation; Such as happen's  
 when water & lime, & some other materialls are  
 commixt, w<sup>ch</sup> so assimilate y<sup>e</sup> water, tho but In  
 neer Equall Quantity, it never Returnes to /y<sup>e</sup> forme of\ water a=  
 gaine. This being y<sup>e</sup> Case of comon air, w<sup>ch</sup> will  
 yeild some, but Not so Much water as air New  
 raised in vapour will, the vertuosi may conceiv  
 air

air.

7

air to be a distinct substance from water, & capable of being wholly cleared from it; w<sup>ch</sup> I will not Much contend with them; but hold to this that all our Com=  
mon air, In dry season's as wett, hath very much of water in /it\ w<sup>ch</sup> will condens & be-come water by application of cold to it. Now setting aside the artificial mean's, by distillation, and Experiments Extraordiary, of demonstrating this; I will take onely the accidentall, & comon, w<sup>ch</sup> are y<sup>e</sup> best ex=  
periments, for this reason, If there were No other, they have No fucus as an artist is apt to Embellish his operation's with, to make them appear fair, but Naked truth, such as most people doe, or may Every day observe.

And It is accordingly observable, that the Water p<sup>r</sup>=cipitates most out of Air, In y<sup>e</sup> Confines of heat, & cold. The Reason I take to be, that y<sup>e</sup> alteration doth Not so soon penetrate, Into an whole body of air as it works at the part y<sup>t</sup> first Receivs it; and It Cannot have Effect in y<sup>e</sup> Midle but in time, & by Slow degrees; & often In y<sup>e</sup> Mean time, y<sup>e</sup> Caus is re=  
moved by accession of y<sup>e</sup> Contrary. But this Remarq is So Sure that I durst affirme No Instance can be Given In Comon occurences (for I medle Not with vext Experiments) of of conterminous heat and Cold In y<sup>e</sup> air, without Moisture. It is Every day's Spec=  
tacle, /that\ of wine cooler then y<sup>e</sup> air In a Glass, w<sup>ch</sup> cools y<sup>e</sup> Mettall, ~~It~~ /& so\ Causeth a Mist to sitt on y<sup>e</sup> out=  
side of y<sup>e</sup> Glass, w<sup>ch</sup> /and that mist\ at length will Coalesce Into  
sensible

## 8. air.

sensible dropps; If In a fresh Morning after a Cool Night, a coach stand is set /out\ with y<sup>e</sup> door obverted to the warm sun, /the warmth of that\ that thro y<sup>e</sup> wood /shall\ warme y<sup>e</sup> air, In the case, ~~so that If the Glass~~ /and y<sup>e</sup> Glass being Cool within Shall be all misty & wett as if it\ be drawne up, will appear, and then standing in y<sup>e</sup> air, & heat, but a litle, It all goes off. It were tedious here to bring all y<sup>e</sup> Instances of this as are obvious, I Reserve some, as more Imediately concern y<sup>e</sup> Weather & y<sup>e</sup> baroscope, to those heads.

These are the cheif phenomena of the air, and it is a matter of w<sup>ch</sup> by y<sup>e</sup> Mean's of y<sup>e</sup> torricellian Exper=  
rim'<sup>t</sup> wee know a great deal, & gives hopes of Much more to be discovered of it, by Experiment's to w<sup>ch</sup> it is Mainely Exposed, but hitherto, I think there is Not much more knowne of it then is touched upon Here. And there is Nothing that I find needs philoso=  
ficall Explication more Eminently, then Rerefac=  
tion & condensation, so peculiar & constantly an=  
next to it, and then its spring, w<sup>ch</sup> produceth Won=  
derfull Effects, and Gives a Means to arrive at the knowledg of y<sup>e</sup> Nature of all other springs. In other matter's I know No difference /but\, then /air\ may be within y<sup>e</sup> comon p<sup>r</sup>scription's of all other fluids.

As to Rarefaction & condensation, I have Not ffound any sensible, or tollerable account of it, ~~Then~~ but that of Cartesius; Nor doe I find any thing objected to it that is worth taking notice of In particular. as for S<sup>r</sup> Is. N<sup>s</sup>. language, In his Geometrick style, partes sese mutuo oppetentes and sese mutuo fugientes,<sup>411</sup> I p<sup>r</sup>sume he mean's It should be taken (as it is) for Nothing.

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<sup>411</sup> i.e., 'parts facing towards and away each other'

air.

9-

And If he, or any one Els, thinck the Effect unaccountable, It is ffitt they Enjoy their suspension, but Not with Reproof of ought Els that same may thinck reasonable. And as to y<sup>e</sup> Matter these thing's are Considerable, 1. that the smallest matter hath swiftest motions, becaus Every bigger makes a lesser move with all its swiftness, but Not E. Contra. And therefore the action's of fluids doe communicate more in y<sup>e</sup> Smaller then In y<sup>e</sup> larger Materiall. And the greater are kept from Rest, w<sup>ch</sup> is Enough for y<sup>e</sup> Conservation of fluidity, by y<sup>e</sup> Smaller. Then. 2. the Materiall of w<sup>ch</sup> common vessells are made, as wood, Horn, Glass, & mettalls, are wholly Impervious to air or water, and will burst, before any such shall be compressed thro their limitts. But yet None can say, but they are pervious to y<sup>e</sup> Small matter, w<sup>ch</sup> also fills the Interstitiall places of y<sup>e</sup> air. So that a vessell to y<sup>e</sup> air, is like an Hedg when y<sup>e</sup> leaves are off, to straws & Hay carryed dispersely in y<sup>e</sup> wind, y<sup>e</sup> latter shall pass thro, but y<sup>e</sup> other Shall stick by y<sup>e</sup> way. 3. That Irregular body's agitated swiftly /strike one & other with\ so much y<sup>e</sup> More force, as y<sup>e</sup> agitation is violent or Swift. And the tendency or Effect of that must, by y<sup>e</sup> Rules of Movement, to Seperate until the parts doe not Reach to Interfere, or Strike. 4. That this agitation Comes from the Smaller, and is clogged by y<sup>e</sup> Greater parts of a fluid. 5. That Heat (as at p<sup>r</sup>sent wee Suppose) consists In the swifter or slower /agitation\ parts of fluid body's, And this agitation being propagated, Instills a greater disposition of y<sup>e</sup> Irregular or Greater part's to separate.



and 5. lastly, If air consisting of this fluid Matter  
 we<sup>h</sup> Inclosed in a vessell; It is capable of being agi-  
 tated by ye Intermediation of ye Small Interstitiall  
 matter, that passeth & Repasseth with freedome, thro  
 the pores of ye vessell. And being so agitated from Without,  
 the Expansive force, fall's on ye sides of ye vessel, tending  
 to dilate them. And If they are of yeilding stuff, as bladder  
 It /the effect\ will be manifest to ye Eye, as when an half blowne  
 bladder is Exposed to ye fire; it grows turgid, and taken  
 away becomes, flaccid againe, and More so as Cold is  
 augmented. And if heat be augmented ye vessel, if fraile,  
 as of thin glass shall burts. It is pleasant to see a  
 round blowed Glass ball /blowed\ thin, cool in ye air. ffor it  
 will as it Cools crackle & bend inwards with many  
 essay's on all sides and at last burst. so If a Glass, with air  
 of a comon temper in it, be sealed up hermetically,  
 It shall burst outwards.

The great doubdt is made how the space is supplied  
 upon condensation, and /ye matter\ Recruited or filled up to such  
 a compressioned stiffness, upon Rarefaction. - wee say No=  
 thing Els but smaller Interstitiall matter from without  
 by we<sup>h</sup> ye action is comunicated, passing & Repassing  
 doth this feat. other's say Not, What then? vacuity  
 succeeds. Matter is thin & scattered In vacuity, and  
 being agitated bear's upon ye vessells and when Quiet  
 fall closer, & ye vessel If plyant lapps upon them  
 Els vacuity succeeds. Then I ans<sup>r</sup>. first It is allow<sup>d</sup>  
 that Rarefaction is from ye part's In motion stri=  
 king

air

11

=king one & other, the tendency of w<sup>ch</sup> strokes, is to dilate y<sup>e</sup> room So as to the rarefaction wee are agreed. If they Say y<sup>e</sup> part's of fire, (w<sup>ch</sup> language is in y<sup>e</sup> Mouths of Some,) Enter & croud y<sup>e</sup> Space; that cannot be, ffor If there be room to Enter, there is room to Issue out, so No crowding can be from them; w<sup>ch</sup> is an ans<sup>r</sup> with= out asking what they mean by part's of fire. then ffor such plenty of vacuity as some make, after y<sup>e</sup> fancy of y<sup>e</sup> old Epicurean's, - Rebus Mixtum Inane,<sup>412</sup> I have sayd much under y<sup>e</sup> title of plenitude, and I thinck shewed It is Impossible to be after this Man= ner, that is sufficient to accomodate rarefaction & condensation. And the Next article I am to treat is a full Confutation of this p<sup>r</sup>tence. ffor that is the Spring of the air; ffor that is found In some degree In Every place, w<sup>ch</sup> Shew's y<sup>e</sup> Matter Crowded together as close as it will goe. As tye a p<sup>l</sup>a bladder over a violl Glass, w<sup>ch</sup> shall ly true strecht & flatt as a drum. put is so Into y<sup>e</sup> Receiver,<sup>413</sup> & take out y<sup>e</sup> air & y<sup>e</sup> Spring within will shew it self, by urging y<sup>e</sup> bladder to a very strong tension outwards, & per= haps burst it. take this out, & y<sup>e</sup> Spring of the out= ward air being Stronger Reduceth that to y<sup>e</sup> former Equation, & flatts y<sup>e</sup> bladder. Cool the Glass artifi= cially, and y<sup>e</sup> bladder Shall be Crouded hard In= wards. for y<sup>e</sup> air within Condensing y<sup>e</sup> Spring with= out, presseth it In. Where now can be found va= cuity to answer this process; to Shew is to demonstrate.

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<sup>412</sup> This is probably a half-remembered reference to Lucretius, *De Rerum Natura*, I:366-9: *contra gravius plus in se corporis esse dedicat et multo vacui minus intus habere. est igitur ni mirum id quod ratione sagaci quaerimus, admixtum rebus, quod inane vocamus.*

Even as the heavier more of matter shows,  
And how much less of vacant room inside.  
That which we're seeking with sagacious quest  
Exists, infallibly, commixed with things-  
The void, the invisible inane  
(translation, William Ellery Leonard, 1916 downloaded from <http://www.perseus.tufts.edu>, August 2013.)

<sup>413</sup> This is the term used by Robert Hooke to describe his evacuated chamber in the vacuum pump he made for Boyle.

There is another sort of Rarefaction, w<sup>ch</sup> is so Et Extravagent and amazing, I Shall afford it Much thought apart, It is knowne by y<sup>e</sup> title of Explosion, And I thinck discovers an Efficacy In y<sup>e</sup> minute Interstitiall matter of our world, Not so violently made knowne to us any other way. but Comon Rarefaction wee Account No other, but an agitation raised In fluid matter, w<sup>ch</sup> is not so Small as to pass y<sup>e</sup> pores of Comon vessells, and therefore the force of that agitation falls upon y<sup>e</sup> sides to dilate them, and doth it, when they are not rigid but yeilding. and y<sup>e</sup> room gained is Supplied by Subtiler Matter, to w<sup>ch</sup> y<sup>e</sup> vessells are readily permeable; And condensing is the alternate, and y<sup>e</sup> same Interstitiall matter gives way to y<sup>e</sup> Condensation. And Since this solution is grounded on y<sup>e</sup> Rules of motion, Not onely possibly, but actually working, and without any Contradiction to any knowne truth, ~~no~~ /or\ as I thinck Improbability /If wee may Judg\, /of thigs unseesn\ according to the visible effect's of Motion; /wherefore\ untill a better solution is discovered, there is No Reason to Reject this.

It May Not be a miss to Remember y<sup>e</sup> difference put by Cartesius between y<sup>e</sup> state of water, and vapour, w<sup>ch</sup> is water, but Exhaled by heat, & become air. As for his fancy that water takes y<sup>e</sup> shape of Eles, It may agree well Enough with the pha<sup>e</sup>nomena; as iff a Gyant as bigg as England Should put his hand Into y<sup>e</sup> Atlantick ocean, full of live Eles he would have

have an Idea, Much like ours of water. ffor they  
 Would turne about y<sup>e</sup> Crevices & asperity's on his hand,  
 & be as that wee Call wetting. but this Seeming apt=  
 ness is No argument it is true, and it is a vanity  
 to take an hypothesis w<sup>ch</sup> may be ad libitum Refused.  
 Therefore let y<sup>e</sup> flexibility of the part's Goe, I shall  
 Contend onely that they are long; w<sup>ch</sup> I prove by what  
 must be according what is declared, thought true of  
 Rarefaction. ffor If they were Globular, the action of  
 them however Swift could make No Expansion, If  
 Ovall or Cubick, then somewhat of y<sup>t</sup> Might happen  
 but Not Much; but if oblong, then to gain an In=  
 tire sphear for their Movement, must dilate vastly  
 as wee know water In air is dilated. The while  
 holding y<sup>e</sup> forme of water, the contiguity of y<sup>e</sup> parts  
 is Never interrupted, & y<sup>e</sup> Motion of them is slipping  
 & Not turning, but If turned Into vapour. & so so air  
 It is turning, & Not slipping; ffor w<sup>ch</sup> this is an ar=  
 gument, there is No Medium between slipping  
 and turning. ffor y<sup>e</sup> latter once taking, there is an  
 End of y<sup>e</sup> other; and y<sup>e</sup> passing from vapour to water  
 is like a thing falling downe; & then sliding amongst  
 y<sup>e</sup> Rest. And the Cohesion of y<sup>e</sup> part's when water, &  
 Not when air, for then they scatter Every way, &  
 one air mixes with another. (as Waters also doe)  
 but water folds over one y<sup>e</sup> other & ly close. so that  
 y<sup>e</sup> air

air Cannot penetrate into y<sup>e</sup> Midle, without first E= vaporating at y<sup>e</sup> sides, or turning y<sup>e</sup> whole Into va= pour, for w<sup>ch</sup> reason, y<sup>e</sup> air rather Compresseth the bo= dy of water & holds it together, & what is removed of it is by partes Evaporated, as heat is from y<sup>e</sup> Sides. This is what May be true according to y<sup>e</sup> Rules of body's moved, and as such wee p<sup>r</sup>sent it.

As to the consequences of pressure, w<sup>ch</sup> I take to be the caus both of holding water in its forme, and also of culinary fire, they shall be toucht in due place. But I must Next to come orderly to it consider y<sup>e</sup> Weight of y<sup>e</sup> Atmosphear.

It was Noted, that the almosphear was Not termina= ted aloft, as water is, by a sphericall Superficies /and all of a spissure\ but ceased<sup>414</sup> & thro all degrees of rarity /from y<sup>e</sup> Surface of y<sup>e</sup> Earth upwards\ comes to Nothing at last; and a Compressure<sup>415</sup> of the whole is graduated accordingly, the lowest allwais being Most Com= prest, & higher less, & aloft Nothing. But this is Most constant, this body of air compressed as it is, doth Not ~~succumb~~ Succumb, but Resists, and is Ever ready to gaine room, and failes Not /of\ Effect accordingly When way is made. And this force of Result or Expansion In y<sup>e</sup> air on one Side working against, the Weight of the super Incumbent on y<sup>e</sup> other side; is allway's In ballance or equality, that is as the Weight in any one place is Equall to y<sup>e</sup> Resisting spring, so it is Equall In every other place; but y<sup>e</sup> force of both, as I sayd is according to altitude from y<sup>e</sup> Earths surface, ffor that Continually lessens the Incumbent weight

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<sup>414</sup> The word 'from' in the margin - not apparently related to the text in any way.

<sup>415</sup> Change of pen.

air.

15

Now it passeth In Speech promiscuously, to ascribe the consequences of this force sometimes to y<sup>e</sup> weight of y<sup>e</sup> air, & sometimes to y<sup>e</sup> spring, and on account of this Equallity, it is all one w<sup>ch</sup>. but as to y<sup>e</sup> Nature and Energy of y<sup>e</sup> Spring Not; ffor Some body's ae Compressed to a degree, as lead, or wax, w<sup>ch</sup> have No Spring to Result when y<sup>e</sup> force Removed. Therefore wee Must Inquire after this principle of Result; tho wee cannot sever it from y<sup>e</sup> Gravity of y<sup>e</sup> air.

It is No other then the rarefaction was before described but where is y<sup>e</sup> Confinement, w<sup>ch</sup> In y<sup>e</sup> former discours was Supposed to Inclose y<sup>e</sup> Grosser matter so as to Receiv y<sup>e</sup> force of its Expansion, & So Make it appear. I answer, It is the Comon Gravity of it. There is In all places a tendency of y<sup>e</sup> air towards y<sup>e</sup> Earth, In a perpendicular direction. If it were Not for that, y<sup>e</sup> Spring of the Air were dissolved; for It would dilate to y<sup>e</sup> utmost Expansion, & y<sup>e</sup> parts dissipate. but the Gravity of y<sup>e</sup> whole, surrounding y<sup>e</sup> Intire Globe, almost Indifferently, is a confinem<sup>t</sup> Quasi a vessell, In w<sup>ch</sup> the Materiall is pent so as Not freely to Expand, & that Makes y<sup>e</sup> Spring apparent. for the Consequence is, when any Substance Immerst in air, hath any part not capable to Resist this force, as the Mercury, In y<sup>e</sup> barometer ~~In a short~~ /& when y<sup>e</sup> \ columne is too short, this spring bent with a Stated weight of y<sup>e</sup> air In that place, Crouds that way, & raiseth the mercury from y<sup>e</sup> Stagnum upwards but This belongs to y<sup>e</sup> discours of y<sup>e</sup> barometer.

16. air.

One Effect of this Spring is very Especially to be Noted and for the analogy or resemblance it hath with y<sup>e</sup> waves upon a watry surface, but More becaus the propagation of all Sound is from it. And that is If any accidentall Compressure happens in any part of the air, the Expansive force there Compresseth the next & that the Next, and so a Comprest wave spreads in sphericall forme, as y<sup>e</sup> waves upon water in Circular, perpetually wasting: this is demonstrated Enough by <diagram> the passage of sound, w<sup>ch</sup> is No other, but It being an Invisible process wee must help y<sup>e</sup> Imagination a litle appealing to C/S\ome Caus/ommon\ occurances of Experiment, to make it familiar and understood. Suppose a worm Rolled of Springy wire A.B. and of Great length, suspended at both Ends; If a violence Comes upon y<sup>e</sup> part B. from E. and Makes a conspissure of y<sup>e</sup> Spires of y<sup>e</sup> wire, whose tendency is stait to dilate. the Conspissure would pass along the worm by C. to D. And as Strangly being 'again\ Crowded at D. will Returnes to A. & so back againe, continually decreasing. this is a Rep<sup>r</sup>sentation of an oblong. But this Experim<sup>t</sup> of y<sup>e</sup> like I have Made. Standing /below\ by one of the Stay's, of Engin-sheers<sup>416</sup> /upon y<sup>e</sup> highest wall\ at y<sup>e</sup> building of Pauls, w<sup>ch</sup> was a Rope of Great length & stiffness. I strok y<sup>e</sup> Rope Near y<sup>e</sup> fastning with My Cane, & then observed with my Eye, and also layd my hand on y<sup>e</sup> Rope.

And

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<sup>416</sup> An 'A' frame, or derrick, a lifting device.

And first I could see y<sup>e</sup> bow Made with y<sup>e</sup> Stroke  
 pass up to y<sup>e</sup> Crowne of the Sheers, & then Downe a=  
 gaine, & so up and downe divers times, all the While  
 perceiving Grossly the Returnes, with My hand on the  
 Rope, and when I could discerne No movement at  
 all of y<sup>e</sup> Rope, I could, with My hand Most sensibly  
 feel a succession of Returnes Continually More languid  
 for a considerable time, and In such a Manner, that  
 I could readily conceiv. If my Sence had bin Nicer I  
 Might have perceived yet More, and perhaps, barring  
 accident's, ad Infinitum. And one thing observable was  
 that all these Impression's of y<sup>e</sup> Stroke passing and Re=  
 passing, made their Returnes, to My best acc<sup>o</sup>, In E=  
 quall times.

There is another Experi<sup>m</sup>t of like Nature, and of  
 a body wholly void of Spring, as y<sup>e</sup> Comon Notion of  
 a Spring is, but In truth Moved with all analogy to it.  
 Take a Comon Cart-rope and Extend it strait  
 <diagram> upon y<sup>e</sup> Ground, as at A.C. and  
 then lift up y<sup>e</sup> End. A. & with  
 a flap lay it downe againe. that Shall Make an  
 Arch of y<sup>e</sup> Rope as at B. w<sup>ch</sup> shall pass along y<sup>e</sup> Space  
 to. C. & there Dye. but If C. be staked downe; an  
 arch of lesser forme will begin a Returne, but Not  
 last for want of force, w<sup>ch</sup> in this Experiment  
 wasts apace. The Reason of this Effect is, that  
 some

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<sup>417</sup> Return to the same kind of pen as in the first part of the essay.



some part of y<sup>e</sup> Rope is moved /with a direction\ towards the Rest, and so one part moved moves y<sup>e</sup> Rest In y<sup>e</sup> Same direction, but y<sup>e</sup> Stiffness of y<sup>e</sup> Rope is a great wast to y<sup>e</sup> force but for all that, as farr as I could discerne, the wa arch went along at an Even pace, neither Re= tarding Nor Accelerating. And The caus of that I take to be, that the case is of Equalls upon Equalls, w<sup>ch</sup> allwais give Equall velocity, & Rest. w<sup>ch</sup> May be con= firmed by y<sup>e</sup> Experiment of a long Coach whip. ffor If the force of the Man's arm be directed to y<sup>e</sup> lanyard or fall of it. w<sup>ch</sup> lessen's continually to y<sup>e</sup> point, Shall when contracted to that, (having accelerated all y<sup>e</sup> Way) bring it about with Swiftnes as Shott out of a gun, & Excoriate as bad. Therefore If y<sup>e</sup> Rope Could be so ordered as to be taper also. If y<sup>e</sup> motion began at the heavyer End It would accelerate & be Swiftest at y<sup>e</sup> smaller End. This is y<sup>e</sup> Case of the Greater upon less. w<sup>ch</sup> Gives y<sup>e</sup> Encreas of swiftnes directly, as upon Impulses, (w<sup>ch</sup> Cannot be) but be= Caus it moves more at a time. as y<sup>e</sup> Equall sised Rope lifted Just as much as it layd downe, y<sup>e</sup> tapered Rope lifted More & more continually; for Equalls will Not Give their swiftnes to any greater then Equall, but any force y<sup>t</sup> will do So /to\ an Equall, is y<sup>e</sup> Same If it be drawne into length, as if it lay round. therefore the force takes up more of y<sup>e</sup> smaller then it would doe of an Equall size; and less of a greater, for  
the  
the

air.

~~19.~~

the alternate reason. And so beginning y<sup>e</sup> Movem<sup>t</sup> at y<sup>e</sup> smaller End. It will Carry the arch Continually slower, and perhaps languifye before it gaines with it the farther End.

It is My Concept, and I must leav it to the Curious to Examine & Judg. that In all these fluent movements, whither y<sup>e</sup> force be greater, or slacker, the fluency is with y<sup>e</sup> Same Speed, and that is Not derived from the o<sup>r</sup>iginall force, but from the Nature or Spissure of the materiall Concerned. And the same will appear I thinck visibly (as well as y<sup>e</sup> Ey Can keep account) upon y<sup>e</sup> Surface of water. the Reason is that however strong y<sup>e</sup> force is that Makes y<sup>e</sup> Impression y<sup>e</sup> Subsequent [flour?] is derived, Not from y<sup>e</sup> originall force, but the Restitutive principall of the body. so water Is by a mild or violent stroke Raised In a small hill. It is the power of that descen<sup>d</sup>ing, from a principle of Gravity, w<sup>ch</sup> makes, y<sup>e</sup> Next and so y<sup>e</sup> Next water rise, & y<sup>e</sup> undulation's Spread. And you Shall observe that however y<sup>e</sup> water is dis<sup>t</sup>urned, those Jogg on at y<sup>e</sup> Same Rate. And When an Arch of a Rope is raised, It is y<sup>e</sup> Weight Makes it pro<sup>p</sup>agate by falling. And when a Compressure is Made In y<sup>e</sup> wire-worm, or In y<sup>e</sup> air (w<sup>ch</sup> I shall Call the Comprest wave) It is the principle of Expansion that Carry's it on, and If it be violent at first (as I grant violence Extraordinary disturbs Isocronismes) It Soon falls Into y<sup>e</sup> temper of the materiall, & Moves upon it.

20.

Air.

Therefore If there were an Immens tube of air. A.D.

<diagram> with a comprest wave in it  
at C. directed towards. D.

The force would all propagate by mean's of y<sup>e</sup> Spring towards. D. and there the vis Impressa (Not so strong as at C. because of y<sup>e</sup> accidents, as friction) Recruits the Compression. And that dilating Returns y<sup>e</sup> Wave back againe, but with less strength as less Compres't. but Moves along to A with y<sup>e</sup> Same swiftness, & so by like Returns continually. A reason for the perpetuall Isocronisme of y<sup>e</sup> motion, whither y<sup>e</sup> wave may be more, or less Comprest; may be, for that the force is from the principle of Expansion /of y<sup>e</sup> fluid it Self\ & Not adventitious and the Resistance is allwais Exactly Equall to the force, ffor y<sup>e</sup> Resistance is the Same principle of Expansion Residing in it. So if the Compression be Small, the Resistance is small, and y<sup>e</sup> less compressure propagates y<sup>e</sup> force. but y<sup>e</sup> force of Expansion is allwais y<sup>e</sup> same. consequently the compressure /whither more or less\ passeth allong y<sup>e</sup> body with Equall speed; Here wee Suppose the tube /Exactly\ Equall. And then the deminution of y<sup>e</sup> force is wholly from y<sup>e</sup> friction and other accident's, if any come from the texture of the parts. ffor a dens body such as we may conceiv a thick smoak, gives not such a speed to y<sup>e</sup> wave as air, and y<sup>e</sup> finer y<sup>e</sup> air, the nimbler y<sup>e</sup> wave, but In one & other the going & Returning, as the Experiment of y<sup>e</sup> high rope, In Exact Equall time, [bating?] onely y<sup>e</sup> Slakening by friction of y<sup>e</sup> Sides.

air.

21.

Much depends on this rule If It be, as I suppose, true; and as to that I beleev, one may from comon observation prove it. The case of water goes so farr that y<sup>e</sup> force y<sup>t</sup> occasion's y<sup>e</sup> undulation's doth Not (after the cours of them obtain's) Influence their Speed. but Its true they doe Not dilate equably, but proportionably of w<sup>ch</sup> y<sup>e</sup> Reason May be Shewed. yet If y<sup>e</sup> Experiment were tryed In a trough, of great length, y<sup>e</sup> undulations would pass as y<sup>e</sup> Comprest wave, Equably. The Rope on y<sup>e</sup> Ground I have touched, and also the high Rope. but to Come neerer y<sup>e</sup> air. whoever sees an hatchet move at a distance, may observe Intervalls, between y<sup>e</sup> Stroke, & y<sup>e</sup> Sound, w<sup>ch</sup> is y<sup>e</sup> time y<sup>e</sup> air passeth along In a Comprest wave. and No on could observe any difference In y<sup>e</sup> time whither y<sup>e</sup> Stroke were light, & or heavy. And I think y<sup>e</sup> Experienze del cimento,<sup>418</sup> Shew that there is litle difference In y<sup>e</sup> passage of sound, Whither with or against the wind. W<sup>ch</sup> brings the case, as I sayd, to that of Equals upon Equals; and the velocity allwais y<sup>e</sup> Same, that is the force of dilating, If it hath more force, it hath more Resistance, If less force less Resistance, for it is opposed to it self, & the Result must be a perpetuall Equability of y<sup>e</sup> Movem<sup>t</sup> when The circumstances are as wee have Supposed

The manner of y<sup>e</sup> force Ceasing, from y<sup>e</sup> waves being less comprest, is that it is broader, so determines Not till It is extended In breadth to the utmost; this is  
p<sup>r</sup>sented

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<sup>418</sup> The *Saggi di naturali esperienze fatte nell'Accademia del Cimento ...*, first published in 1666, was a manual for laboratory procedure. The Accademia del Cimento ran in Florence for ten years, from 1657-67. Its members included students of Galileo, with others, under the protection of Prince Leopoldo De Medici and Grand Duke Ferdinando de' Medici. RN's brother Dudley had met the Grand Duke in 1661 (on his journey from London, via Archangel to Turkey). The Accademia was typical of the many scientific academies and societies springing up in the mid century for its emphasis on experiment and empirical research. Although it is not certain that the Accademia was closed on the orders of the Roman Church, it was certainly widely believed to be true. RN refers to the book, although he does not appear to have a copy to hand to prove his point (but then, that is not how he usually argues).

22. air.

<diagram> to y<sup>e</sup> Eye by y<sup>e</sup> wave on  
 a watry surface. ffor as  
 that dilates, it is less  
 Exalted, and spreads broa=  
 der, and at length is, to y<sup>e</sup> Sight, lost in breadth.

Now If In a p<sup>r</sup>supposed tube, there are 2. Compres't  
 waves at. A. & at. B. and these meet Exactly in  
 y<sup>e</sup> midst at. C. It is plaine, they Compress Each other  
 as at a Solid stop, & so work backward, & foreward  
 in like manner as In two tubes. And as this is devided  
 In halves, So It may be Into any other aliquot<sup>419</sup> parts  
 as Quarters. D. & E. observing /whither\ Equall devisions & /or\ Not  
~~odds~~. ffor If there be odd. as In. 3. then If the wave  
 <diagram> between [A?]. & C. meet that  
 B. from A. In D. that tow=  
 ards. B. may be at that End.  
 and when that with y<sup>e</sup> Midle  
 wave meet in. C. that towards. A. will be at y<sup>e</sup> End  
 at. A. and so alternately. And it is to be observed  
 that this alternation of divers comprest waves In our  
 tube, cannot subsist but In Equall devisions, for w<sup>ch</sup>  
 y<sup>e</sup> Reason is plaine, and depends wholly on the per=  
 petuall Isocronisme of y<sup>e</sup> motion, ffor If in any one  
 devision It moved faster or slower, then another  
 Might overtake it in y<sup>e</sup> Same direction, or Come against  
 it with unequall strength, or If y<sup>e</sup> Spaces were une=  
 qually sett, the like Inconvenience would happen  
 and y<sup>e</sup> movements, If severally and unequally /Instituted\ at  
 first, would forth work into aliquot y<sup>e</sup> is Equall devisions  
 w<sup>ch</sup> would be Remembered when wee come to discours of  
 musicall sounds.

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<sup>419</sup> i.e., 'some'

air.

23

Now If Instead of a compres't wave, moving along a tube, or rather. 2. to Reinforce Each other In the midle. there were a solid body In the midle, (W<sup>t</sup>out <diagram> Gravity or friction) w<sup>ch</sup> had a force Imprest In it tow= ards Either A. or B. and Endued with a Strong perseverance. ~~ef=f~~ at first directed towards B. it Compres't the air, into a Strong tendency to dilate, at length Sufficient to Repell y<sup>e</sup> body; w<sup>ch</sup> Repuls taking place It shall move back with a force Imprest by the strength of the Expansion And I may add also the force of the Retraction, Supplanting /(as to y<sup>e</sup> air between A. & C. that is of no signification be=\ caus it tends alwais to Expand, & so doth Not Retract y<sup>e</sup> body at all) And Augmented by a continuance of the Expansion as farr a C. where that Ceaseth: then at. C. the body hath less force to Move towards. A. then was ffirst Imprest at C. & In like manner Every Re= turne y<sup>e</sup> force of y<sup>e</sup> movement at. C. is less, & less.

Now the like reasoning takes here. ffor Whither. C hath more or less force it stopps to y<sup>e</sup> Incoation of its Returne In y<sup>e</sup> Same time. ffor Say more, then It /is swifter & goes farther, & Excites a stronger compression, at y<sup>e</sup> End. Say less, then the Resistance ~~is less and~~ /as well as\ y<sup>e</sup> velocity is less; and It goes Not So farr, and a less compression stops it. Note that dif= ference of force in y<sup>e</sup> Same body is Swiftness. Abate the Swiftness and you abate the opposition; the Result is, The stops shall happen in y<sup>e</sup> same time.

take 2. body's that have different velocity's & Equall substanc

substances. let 2 forces Gradually Increasing ~~/sufficient/at length/to stop them\~~ oppose Each of these, as may in some time stop them. If in ~~/the\~~ ~~/proceeding\~~ the force opposed to the Swifter, Increases by degrees faster, then the force opposed to y<sup>e</sup> Slower, In y<sup>e</sup> Same proportion as the velocity's differ; they Must Stop both at the Same Instant. That is the Case. And the Exciting the Motion of Returne, from y<sup>e</sup> beginning of it, the same Reason takes place. ffor the Stronger Compression is, being Never More then the body, with y<sup>e</sup> vis Impressa, makes, the Swifter the Returne is. So that If the Space to be run from a faint Compression, be less In propor= tion, then that from a strong Compression, as y<sup>e</sup> forces of y<sup>e</sup> Compression are to Each other, then the body Must Returne to. C. when y<sup>e</sup> force ceaseth, In Equall time, Whither It went faster to Make a stronger, or Slower to make a fainter Compression.

But in all these Cases it is to be Considered, that if y<sup>e</sup> first Institution be very violent so as to Exceed the ordi= nary power of y<sup>e</sup> Expression with Respect to such a body, the first Swing's may be violent, Irregular, or swifter in Returne, then afterwards. ffor violence disturbs y<sup>e</sup> operation of y<sup>e</sup> Compressure, w<sup>ch</sup> according to y<sup>e</sup> tone of y<sup>e</sup> fluid, Requires a certain time more or less to work. Els being violently opposed, it makes a sort of Explosion; but the Most Equable action of the Compressure, is when it is least disturbed, neer y<sup>e</sup> [marg]<sup>420</sup> place of it's Cessation one way other. ffor all things Require a moderation of forces acting & Reacting. proportioned to Each other. This is found In heavy

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<sup>420</sup> marg.: 'q<sup>a</sup>'

air.

25-

pendulums, when set at two wide swings, the vis  
Impressa is so great, as to be too hard for y<sup>e</sup> power  
of Gravity, & makes y<sup>e</sup> Returnes swifter, then ordinary  
<diagram> Then let us suppose that  
The tube it self A.B. with  
y<sup>e</sup> Columne of air Inclosed  
should by any force Suddenly, from A. to B.  
or contra, and at. C. were a stop of the Included  
air. So as the air In y<sup>e</sup> parts A. & B. be alternatly  
Compressed, It is certein that The body A.B. would  
vibrate in Equall, or neer Equall, times; And the rea=  
son is but y<sup>e</sup> former discours Revers't. And In all  
cases of motion, the rule of Revers holds true. ffor it  
is all one to y<sup>e</sup> force, Whither one or other be y<sup>e</sup> Smiter,  
the Event is but Separation. tho In single Instances  
after y<sup>e</sup> Stroke some Consequences grow y<sup>t</sup> seem to  
distinguish, as hath bin observed.

Then what holds true in this case of y<sup>e</sup> /airs\ spring, pro=  
ceeding from a stated force of dilation, Excited by  
Compressure. Will hold In all cases of stated force In  
any certein direction bound up as y<sup>e</sup> Comprest air  
In a tube, to Certein limits, within w<sup>ch</sup> it operates  
more, as it more urged within y<sup>e</sup> limitts /or opposed, and less in y<sup>e</sup> Contrary, downe to  
Nothing\. They say  
of Algebra, that it is Excellent becaus it deals in  
Quantum's abstracted, and is aplied to all things  
In y<sup>e</sup> World alike. so I say of phisicks; that certein  
action's may be found /In some cases\ that are applycable to all  
forces in y<sup>e</sup> world, and have y<sup>e</sup> place of theoremes,  
as In Mathematicks, but before I apply to those porposes  
I must prosecute this reasoning a bit farther.

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<sup>421</sup> Red BM stamp in LH margin (overlapping modern binding) level with the top of second paragraph.

<sup>422</sup> In this case the number has been erased rather than crossed out.



26. air.

Here Respecting y<sup>e</sup> consequences of Equability wee have conserved y<sup>e</sup> Same materiall to act, & Re-act, and to have y<sup>e</sup> Same Resistance; so as force & Resistance are Ever Equall, & what wants in our one, fails also In y<sup>e</sup> other, In a paralell series of gradation, from y<sup>e</sup> utmost to Nothing.

<diagram> Whereever y<sup>e</sup> materiall Grows more solid & massiff, the movement looseth velocity, as from A. to B. y<sup>e</sup> Comprest wave, Grows less, becaus the substance to be moved is Increast, and so from B. to A. it deminisheth. Now upon y<sup>e</sup> Surface of water w<sup>ch</sup> is superficiall measure, the undulation's move with less speed, as y<sup>e</sup> diameter's Increast. In proportion Reverst. so as, Equall spaces on y<sup>e</sup> diameter, give a diminution of speed, In y<sup>e</sup> proportion of squares. v<sup>ist</sup> as y<sup>e</sup> speed of spreading on a longer diameter, is to that on a shorter, so is y<sup>e</sup> square of y<sup>e</sup> shorter, to y<sup>e</sup> Square of y<sup>e</sup> longer. Now transforming this measure to y<sup>e</sup> air, It will be found, y<sup>t</sup> y<sup>e</sup> Comprest wave Spreads in Sphears & Not In circles, so y<sup>e</sup> whole solid in y<sup>e</sup> Sphear of ~~dila~~ /the\ ~~Exp~~ proceeding, is to be past thro or more, and then it becomes solid measure, & In proportion of Cubes, as y<sup>e</sup> other was of squares, Reverst. w<sup>ch</sup> being obvious I dilate no farther upon. Referring y<sup>e</sup> Rest to y<sup>e</sup> Case of Sounds. onely observe here how Infinity, In Extension & Subdivision ans<sup>r</sup> one & other. ffor when the space of the sphear is Infinite In Magnitude, the motion is deminish't to Nothing, & Not (notionally) sooner.