

**AN ESSAY TOWARDS  
A NEW THEORY OF VISION**

**By**

**George Berkeley**

(Based on the First Edition, Dublin, 1709)

Edited by David R. Wilkins

2002



## NOTE ON THE TEXT

The first two editions of *An Essay towards a new Theory of Vision* were published in Dublin in 1709. Revised versions of the Essay were also published in 1732 with the first and second editions of *Alciphron*.

Berkeley made some significant changes in the in the Second Edition of 1709. In particular, section 73 was modified and considerably extended; the third consideration of section 70 was reworded; and an appendix was added.

Numerous changes were made in the 1732 editions. In particular, Berkeley excised or reworded numerous references to mathematicians and writers on optics in general, and to others with whom he was in disagreement. He deleted section 160 (the final section), though including its first sentence at the end of the previous section. The appendix to the Second Edition was not included in the 1732 editions.

The following edition is based on the First Edition of 1709. However a small number of changes have been made, as described below.

The errata listed after the table of contents, and certain other obvious errata have been corrected.

In Section 29, the words ‘puuctum’ and ‘suntentiam’ have been corrected to ‘punctum’ and ‘sententiam’ respectively.

In Section 130, the word ‘perciev’d’ has been corrected to ‘perceiv’d’.

In general, this edition follows the spelling, punctuation and capitalization of the original text. (However it does not follow early eighteenth century conventions with regard to quotations, whereby a quotation mark is printed at the beginning of every line of quoted text.)

The following archaic spellings in the 1709 edition have been retained: vertue, shou’d, tho’, wou’d, stedly, plains, supplys, tenents, extreamly, throughly, thro’, determin, perswaded, examin, stroak, applyed, chuse, unite [unit], croud, accomodated, surprizing. Note however that the spelling of some of these words is not consistent in the 1709 edition.

In section 12, the second question mark (following the word ‘*Pupil*’) was a full stop in the original 1709 first edition.

A certain number of full stops have been changed to colons, semicolons, or commas, where an incomplete (verbless) sentence would otherwise result. The first letter of the following word has in many instances been changed to lower case. In such cases the punctuation of the 1732 edition appended to the 2nd edition of *Alciphron* has been followed. These changes are listed below:—

in section 4, 1st sentence, a full stop has been changed to a comma before the word ‘it’;

in section 16, 1st sentence, a full stop has been changed to a semicolon before the words ‘it remains’;

in section 20, 2nd sentence, a full stop has been changed to a comma before the words ‘we shou’d’;

in section 23, 3rd sentence, a full stop has been changed to a comma before the word 'but';

in section 26, 2nd sentence, a full stop has been changed to a comma before the word 'it';

in section 27, 2nd sentence, a full stop has been changed to a semicolon before the words 'it being';

in section 60, a full stop has been changed to a colon before the words 'The Visible Magnitude';

in section 92, 2nd sentence, full stops have been changed to a comma and a semicolon respectively, before the words 'so' and 'we';

in section 107, 2nd sentence, a full stop has been changed to a colon before the word 'Yet';

in section 118, 1st sentence, a full stop has been changed to a colon before the word 'In';

in section 131, 4th sentence, a full stop has been changed to a comma before the word 'so';

in section 135, 2nd sentence, a full stop has been changed to a comma before the word '*vid.*';

in section 150, 4th sentence, a full stop has been changed to a comma before the words 'the very *Ideas*'.

David R. Wilkins  
Dublin, December 2002

AN  
ESSAY  
Towards a  
*New Theory*  
OF  
VISION.

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By GEORGE BERKELEY, M. A.  
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*DUBLIN:*

Printed by AARON RHAMES, at the Back of  
*Dick's Coffee-House*, for JEREMY PEPYAT,  
Bookseller in *Skinner-Row*, MDCCIX.



To the Right Honourable  
Sir *John Percivale*, Bar<sup>t</sup>.

ONE OF  
Her Majesty's  
Most Honourable  
*PRIVY COUNCIL*  
IN THE  
Kingdom of *Ireland*.

SIR,

I Cou'd not, without doing Violence to my Self, forbear upon this Occasion, to give some publick Testimony of the Great and Well-grounded Esteem I have conceiv'd for You, ever since I had the Honour and Happiness of Your Acquaintance. The outward Advantages of Fortune, and the early Honours with which You are Adorn'd, together with the Reputation You are known to have, amongst the Best and most Considerable Men, may well imprint Veneration and Esteem, on the Minds of those who behold You from a Distance. But these are not the chief Motives, that Inspire me with the Respect I bear You. A nearer Approach has given me the View of something in Your Person, infinitely beyond the External Ornaments of Honour and Estate. I mean, an Intrinsic Stock of Vertue and good Sense, a True Concern for Religion, and disinterested Love of Your Country. Add to these an uncommon proficiency in the best, and most useful Parts of Knowledge; together with (what in my Mind is a Perfection of the first Rank) a surpassing Goodness of Nature. All which I have Collected, not from the uncertain Reports of Fame but, from my own Experience. Within these few Months, that I have the Honour to be known unto You, the many delightful Hours I have pass'd in Your Agreeable and Improving Conversation, have afforded me the opportunity of Discovering in You many Excellent Qualities, which at once fill me with Admiration and Esteem. That one at those Years, and in those Circumstances of Wealth and Greatness, shou'd continue Proof against the Charms of Luxury, and those Criminal Pleasures, so fashionable and predominant in the Age we live in. That He shou'd preserve a sweet and modest Behaviour, free from that insolent and assuming Air, so familiar to those who are placed above the ordinary Rank of Men. That He shou'd manage a great Fortune with that Prudence and Inspection, and at the same time, expend it with that Generosity and Nobleness of Mind, as to shew Himself equally remote, from a sordid Parsimony, and a lavish, inconsiderate Profusion of the good Things He is intrusted with. This, surely, were Admirable and Praise-worthy. But that He shou'd moreover by an impartial Exercise of His Reason, and constant Perusal of the Sacred Scriptures, endeavour to attain a right Notion of the Principles of Natural and Revealed Religion. That He shou'd with the Concern of a true Patriot have the Interest of the Publick

at Heart, and omit no means of Informing Himself what may be Prejudicial, or Advantageous to his Country, in order to prevent the one, and promote the other. In fine, that by a constant Application to the most severe and useful Studies, by a strict Observation of the Rules of Honour and Vertue, by frequent and serious Reflections on the mistaken Measures of the World, and the true End and Happiness of Mankind, He shou'd in all respects qualify Himself, bravely to run the Race that is set before Him, to deserve the Character of *Great* and *Good* in this Life, and be ever Happy hereafter. This were amazing, and almost incredible. Yet all this, and more than this, SIR, might I justly say of you; did either your Modesty permit, or your Character stand in Need of it. I know it might deservedly be thought a Vanity in me, to imagine that any thing coming from so obscure a Hand as mine, cou'd add a lustre to your Reputation. But I am withal sensible, How far I advance the Interest of my own, by laying hold on this Opportunity to make it known, that I am admitted into some degree of Intimacy, with a Person of Your Exquisite Judgment. And with that View, I have ventur'd to make You an Address of this Nature, which, the Goodness I have ever experienced in You inclines me to hope, will meet with a favourable Reception at Your Hands. Tho' I must own I have Your Pardon to ask, for touching on what may, possibly, be Offensive to a Vertue You are possess'd of in a very distinguishing Degree. Excuse me, SIR, if it was out of my Power, to mention the Name of SIR JOHN PERCIVALE, without paying some Tribute to that Extraordinary and surprising Merit, whereof I have so lively and affecting an *Idea*, and which, I am sure, cannot be expos'd in too full a light for the Imitation of Others. Of late, I have been agreeably employ'd in considering the most Noble, Pleasant, and Comprehensive of all the Senses. The fruit of that (Labour shall I call it or) Diversion is what I now Present You with, in Hopes it may give some Entertainment to one who, in the midst of Business and Vulgar Enjoyments, preserves a Relish for the more Refin'd Pleasures of Thought and Reflexion. My Thoughts concerning *Vision* have led me into some Notions, so far out of the common Road, that it had been improper to Address them to one of a narrow and contracted *Genius*. But You, SIR, being Master of a large and free Understanding, rais'd above the Power of those Prejudices that enslave the far greater Part of Mankind, may deservedly be thought a proper Patron for an Attempt of this Kind. Add to this, that You are no less dispos'd to Forgive, than qualify'd to discern, whatever Faults may occur in it. Nor do I think You defective in any one Point necessary to form an Exact Judgment on the most abstract and difficult Things, so much as in a just Confidence of Your own Abilities. And in this one Instance, give me leave to say, You shew a manifest weakness of Judgment. With Relation to the following *Essay*, I shall only add, that I beg your Pardon for laying a Trifle of that Nature in your Way, at a time when you are engag'd in the Important Affairs of the Nation, and desire you to think, that I am, with all Sincerity and Respect

SIR,

*Your most Faithful*

*And most*

*Humble Servant*

George Berkeley.



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AN  
ESSAY  
TOWARDS  
*A New Theory Of Vision.*

I. My Design is to shew the manner, wherein we perceive by Sight the Distance, Magnitude, and Situation of *Objects*. Also to consider the Difference there is betwixt the *Ideas* of Sight and Touch, and whether there be any *Idea* common to both Senses. In treating of all which, it seems to me, the Writers of *Optics* have proceeded on wrong Principles.

II. It is, I think, agreed by all that *Distance* of it self, and immediately cannot be seen. For *Distance* being a Line directed end-wise to the Eye, it projects only one Point in the Fund of the Eye. Which Point remains invariably the same, whether the Distance be longer or shorter.

III. I find it also acknowledg'd, that the Estimate we make of the Distance of *Objects* considerably remote, is rather an Act of Judgment grounded on *Experience*, than of *Sense*. For Example, When I perceive a great number of intermediate *Objects*, such as Houses, Fields, Rivers, and the like, which I have experienced to take up a considerable Space; I thence form a Judgment or Conclusion, that the *Object* I see beyond them is at a great Distance. Again, when an *Object* appears Faint and Small, which at a near Distance I have experienced to make a vigorous and large Appearance; I instantly conclude it to be far off. And this, 'tis evident, is the result of *Experience*; without which, from the Faintness and Littleness, I should not have inferr'd any thing concerning the Distance of *Objects*.

IV. But when an *Object* is placed at so near a Distance, as that the Interval between the Eyes bears any sensible Proportion to it, it is the receiv'd Opinion that the two *Optic Axes* (the Fancy that we see only with one Eye at once being exploded) concurring at the *Object* do there make an *Angle*, by means of which, according as it is Greater or Lesser, the *Object* is perceiv'd to be nearer or farther off.

V. Betwixt which, and the foregoing manner of Estimating Distance, there is this remarkable Difference. That whereas, there was no apparent, necessary Connexion between small Distance and a large and strong Appearance, or between great Distance, and a little and faint Appearance. Yet there appears a very necessary Connexion between an obtuse Angle and near Distance, and an acute Angle and farther Distance. It does not in the least depend upon Experience, but may be evidently known by any one before he had experienc'd it, that the nearer the Concurrence of the *Optic Axes*, the greater the *Angle*, and the remoter their Concurrence is, the lesser will be the *Angle* comprehended by them.

VI. There is another way, mention'd by the *Optic Writers*, whereby they will have us judge of those Distances, in respect of which, the breadth of the *Pupil* hath any sensible bigness. And that is the greater or lesser Divergency of the Rays, which issuing from the visible Point, do fall on the *Pupil*: That Point being judged nearest, which is seen by most diverging Rays; and that remoter, which is seen by less diverging Rays. And so on, the apparent Distance still increasing, as the Divergency of the Rays decreases, till at length it becomes infinite, when the Rays that fall on the *Pupil* are to Sense Parallel. And after this manner it is said we perceive Distances when we look only with one Eye.

VII. In this Case also, 'tis plain we are not beholding to Experience: It being a certain, necessary Truth, that the nearer the direct Rays falling on the Eye approach to a *Parallelism*, the farther off is the Point of their Intersection, or the visible Point from whence they flow.

VIII. I have here set down the common, current Accounts that are given of our perceiving near Distances by Sight, which, tho' they are unquestionably receiv'd for true by *Mathematicians*, and accordingly made use of by them in determining the apparent Places of *Objects*, do nevertheless seem to me very unsatisfactory: And that for these following Reasons.

IX. *First*, It is evident that when the Mind perceives any *Idea*, not immediately and of it self, it must be by the means of some other *Idea*. Thus, for Instance, the Passions which are in the Mind of another, are of themselves, to me invisible. I may nevertheless perceive them by Sight, tho' not immediately yet, by means of the Colours they produce in the Countenance. We do often see Shame or Fear in the Looks of a Man, by perceiving the Changes of his Countenance to Red or Pale.

X. Moreover it is evident, that no *Idea* which is not it self perceiv'd, can be to me the means of perceiving any other *Idea*. If I do not perceive the Redness or Paleness of a Man's Face themselves, it is impossible I shou'd perceive by them the Passions which are in his Mind.

XI. Now from *Sect. II.* 'Tis plain that Distance is in it's own nature imperceivable, and yet it is perceiv'd by Sight. It remains therefore, that it be brought into view by means of some other *Idea*, that is it self immediately perceiv'd in the Act of *Vision*.

XII. But those *Lines* and *Angles*, by means whereof *Mathematicians* pretend to explain the Perception of Distance, are themselves not at all perceiv'd, nor are they in Truth, ever thought of by those unskilful in *Optics*. I appeal to any ones Experience, whether upon Sight of an *Object*, he compute it's Distance by the bigness of the *Angle*, made by the meeting of the two *Optic Axes*? Or whether he ever think of the greater or lesser Divergency of the Rays, which arrive from any Point to his *Pupil*? Nay, whether it be not perfectly impossible for him to perceive by Sense, the various Angles wherewith the Rays according to their greater, or lesser Divergence do fall on his Eye. Every one is himself the best Judge of what he perceives, and what not. In vain shall all the *Mathematicians* in the World tell me, that I perceive certain *Lines* and *Angles* which introduce into my Mind the various *Ideas* of *Distance*; so long as I my self am conscious of no such thing.

XIII. Since therefore those *Angles* and *Lines* are not themselves perceiv'd by Sight, it follows from *Sect. X.* that the Mind does not by them judge of the Distance of *Objects*.



XIV. *Secondly*, The Truth of this Assertion will be, yet, farther evident to any one that considers those *Lines* and *Angles* have no real Existence in Nature, being only an *Hypothesis* fram'd by *Mathematicians*, and by them introduc'd into *Optics*, that they might treat of that Science in a *Geometrical* way.

XV. The *Third* and Last Reason I shall give for my Rejecting that Doctrine, is, that tho' we should grant the real Existence of those *Optic Angles*, &c. and that it was possible for the Mind to perceive them; yet these Principles wou'd not be found sufficient to explain the *Phænomena* of *Distance*. As shall be shewn hereafter.

XVI. Now, It being already shewn that *Distance* is suggested to the Mind, by the Mediation of some other *Idea* which is it self perceiv'd in the Act of Seeing; it remains that we enquire what *Ideas*, or *Sensations* there be that attend *Vision*, unto which we may suppose the *Ideas* of *Distance* are connected, and by which they are introduced into the Mind. And *First*, It is certain by Experience, that when we look at a near *Object* with both Eyes, according as it approaches, or recedes from us, we alter the Disposition of our Eyes, by lessening or widening the Interval between the *Pupils*. This Disposition or Turn of the Eyes is attended with a Sensation, which seems to me, to be that which in this Case brings the *Idea* of greater, or lesser *Distance* into the Mind.

XVII. Not, that there is any natural or necessary Connexion between the Sensation we perceive by the Turn of the Eyes, and greater or lesser *Distance*. But because the Mind has by constant *Experience*, found the different Sensations corresponding to the different Dispositions of the Eyes, to be attended each, with a Different Degree of *Distance* in the *Object*: There has grown an Habitual or Customary Connexion, between those two sorts of *Ideas*. So that the Mind no sooner perceives the Sensation arising from the different Turn it gives the Eyes, in order to bring the *Pupils* nearer, or farther asunder; but it withal perceives the different *Idea* of *Distance* which was wont to be connected with that Sensation. Just as upon hearing a certain Sound, the *Idea* is immediately suggested to the Understanding, which Custom had united with it.

XVIII. Nor do I see, how I can easily be mistaken in this Matter. I know evidently that *Distance* is not perceived of it self. That by consequence, it must be perceived by means of some other *Idea* which is immediately perceiv'd, and varies with the different Degrees of *Distance*. I know also that the Sensation arising from the Turn of the Eyes is of it self, immediately perceiv'd, and various Degrees thereof are connected with different *Distances*; which never fail to accompany them into my Mind, when I view an *Object* distinctly with both Eyes, whose *Distance* is so small that in respect of it, the Interval between the Eyes has any considerable Magnitude.

XIX. I know it is a receiv'd Opinion, that by altering the disposition of the Eyes, the Mind perceives whether the Angle of the *Optic Axes* is made greater or lesser. And that accordingly by a kind of *Natural Geometry*, it judges the Point of their Intersection to be nearer, or farther off. But that this is not true, I am convinc'd by my own Experience. Since I am not conscious, that I make any such use of the Perception I have by the Turn of my Eyes. And for me to make those Judgments, and draw those Conclusions from it, without knowing that I do so, seems altogether incomprehensible.

XX. From all which it plainly follows, that the Judgment we make of the Distance of an *Object*, view'd with both Eyes, is entirely the *Result of Experience*. If we had not constantly found certain Sensations arising from the various Disposition of the Eyes, attended with certain degrees of Distance, we shou'd never make those sudden Judgments from them, concerning the Distance of *Objects*; no more than we wou'd pretend to judge of a Man's Thoughts, by his pronouncing Words we had never heard before.

XXI. *Secondly*, An *Object* placed at a certain Distance from the Eye, to which the breadth of the *Pupil* bears a considerable Proportion, being made to approach, is seen more confusedly. And the nearer it is brought, the more confused Appearance it makes. And this being found constantly to be so, there arises in the Mind an *Habitual* Connexion between the several Degrees of Confusion and Distance. The greater Confusion still implying the lesser Distance, and the lesser Confusion, the greater Distance of the *Object*.

XXII. This confused Appearance of the *Object*, doth therefore seem to me to be the *Medium*, whereby the Mind judges of Distance in those Cases, wherein the most approv'd Writers of *Optics* will have it judge, by the different Divergency, with which the Rays flowing from the Radiating Point fall on the *Pupil*. No Man, I believe, will pretend to see or feel those imaginary Angles, that the Rays are supposed to form according to their various Inclinations on his Eye. But he cannot choose seeing whether the *Object* appear more or less confused. It is therefore a manifest Consequence from what has been Demonstrated, that instead of the greater, or lesser Divergency of the Rays, the Mind makes use of the greater or lesser Confusedness of the Appearance, thereby to determine the apparent Place of an *Object*.

XXIII. Nor doth it avail to say, there is not any necessary Connexion between confused *Vision*, and Distance great, or small. For I ask any Man, What necessary Connexion he Sees, between the Redness of a Blush and Shame? And yet no sooner shall he behold that Colour to arise in the Face of another, but it brings into his Mind the *Idea* of that Passion which has been observ'd to accompany it.

XXIV. What seems to have misled the Writers of *Optics* in this Matter is, that they imagine Men judge of Distance, as they do of a Conclusion in *Mathematics*; betwixt which and the Premises, it is indeed absolutely requisite there be an apparent, necessary Connexion. But it is far otherwise, in the sudden Judgments Men make of Distance. We are not to think, that Brutes and Children, or even grown reasonable Men, whenever they perceive an *Object* to approach, or depart from them, do it by vertue of *Geometry* and *Demonstration*.

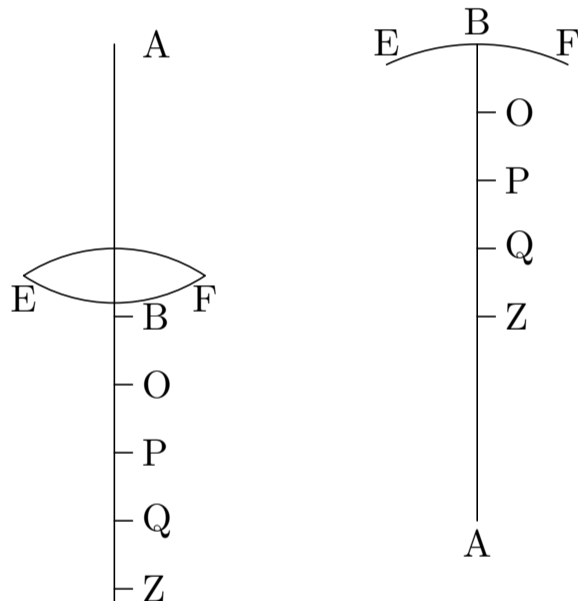
XXV. That one *Idea* may suggest another to the Mind, it will suffice that they have been observ'd to go together; without any demonstration of the necessity of their Coexistence, or without so much as knowing what it is that makes them so to Coexist. Of this there are innumerable Instances, of which no one can be Ignorant.

XXVI. Thus greater Confusion having been constantly attended with nearer Distance, no sooner is the former *Idea* perceiv'd, but it suggests the latter to our Thoughts. And if it had been the ordinary Course of Nature, that the farther off an *Object* were placed, the more Confused it shou'd appear, it is certain, the very same Perception that now makes us think an *Object* approaches, would then have made us to imagine it went farther off. That Perception, abstracting from *Custom* and *Experience*, being equally fitted to produce the *Idea* of great Distance, or small Distance, or no Distance at all.

XXVII. *Thirdly*, an *Object* being placed at the Distance above specified, and brought nearer to the Eye, we may nevertheless prevent, at least for some time, the Appearance's growing more confus'd, by straining the Eye. In which Case, that Sensation supplies the place of confused *Vision*, in aiding the Mind to judge of the Distance of the *Object*; it being esteemed so much the nearer, by how much the effort, or straining of the Eye in order to distinct *Vision*, is greater.

XXVIII. I have here set down those Sensations or *Ideas*, that seem to me to be the constant and general Occasions of introducing into the Mind, the different *Ideas* of near Distance. 'Tis true in most Cases, that divers other Circumstances contribute to frame our *Idea* of Distance, *viz.* the particular Number, Size, Kind, &c. of the things seen. Concerning which as well as all other the forementioned Occasions which suggest Distance, I shall only observe, they have none of them, in their own Nature, any Relation or Connexion with it. Nor is it possible, they shou'd ever signifie the various Degrees thereof, otherwise than as by *Experience* they have been found to be connected with them.

XXIX. I shall proceed upon these Principles to account for a *Phænomenon*, which has hitherto strangely puzzled the Writers of *Optics*, and is so far from being accounted for by any of their *Theories* of *Vision*, that it is, by their own Confession, plainly repugnant to them. And of Consequence, if nothing else cou'd be objected, were alone sufficient to bring their Credit in Question. The whole Difficulty I shall lay before you in the Words of the Learned Doctor *Barrow*, with which he concludes his *Optic Lectures*.

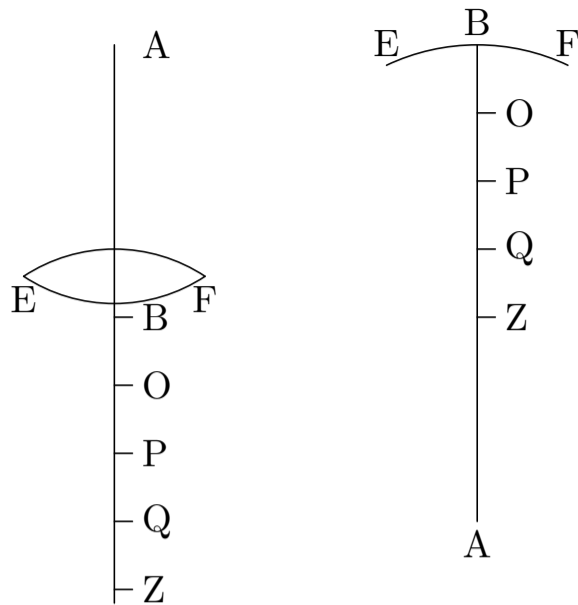


*Hæc sunt, quæ circa partem Opticæ præcipuè Mathematicam dicenda mihi suggestit meditatio. Circa reliquas, (quæ φυσικώτεροι sunt, adeoque sæpiusculè pro certis principiis plausibiles conjecturas venditare necessum habent) nihil ferè quicquam admodum verisimile succurrit, à pervulgatis (ab iis, inquam, quæ Keplerus, Scheinerus, Cartesius, & post illos alii tradiderunt) alienum aut diversum. Atqui tacere malo, quàm toties oblatam cramben reponere. Proinde receptui cano; nec ità tamen ut prorsús discedam, anteaquàm improbam*

quandam difficultatem (pro sinceritate quam & vobis & veritati debeo minimè dissimulandam) in medium protulero, quæ doctrinæ nostræ, hactenus inculcatæ, se objicit adversam, ab eâ saltem nullam admittit solutionem. Illa, breviter, talis est: Lenti vel Speculo cavo EBF exponatur punctum visibile A, ità Distans ut Radii ex A manantes ex inflectione versus axem AB cogantur. Sitque radiationis Limes (seu puncti A imago, qualem suprâ passim statuimus) punctum Z. Inter hoc autem & inflectentis verticem B uspiàm positus concipiatur Oculus. Quæri jam potest ubi loci debeat punctum A apparere? Retrorsùm ad punctum Z videri non fert Natura (cum omnis impressio sensum afficiens proveniat a partibus A) ac experientia reclamat. Nostris autem è placitis consequi videtur, ipsum ad partes anticæ apparens, ab intervallo longissimè dissito, (quod & maximum sensibile quodvis Intervallum quodammodò exsuperet) apparere. Cùm enim quò Radiis minùs divergentibus attingitur Objectum, eò (seclusis utique prænotionibus & præjudiciis) longiùs abesse sentiatur; et quod Parallelos ad Oculum Radios projicit, remotissimè positum æstimetur. Exigere Ratio videtur, ut quod convergentibus radiis apprehenditur, adhuc magis, si fieri posset, quoad apparentiam elongetur. Quin & circa Casum hunc generatim inquiri possit, quidnam omnino sit, quod apparentem puncti A locum determinet, faciatque quòd constanti ratione nunc propius, nunc remotius appareat? Cui itidem dubio, nihil quicquam ex hactenus dictorum Analogiâ, responderi posse videtur, nisi debere punctum A perpetuò longissimè semotum videri. Verùm experientia secùs attestatur, illud pro diversâ Oculi inter puncta B, Z, positione variè distans; nunquam ferè (si unquam) longinquius ipso A liberè spectato, subinde verò multo propinquius adparere; quinimò, quò oculum appellentes radii magis convergunt eò speciem Objecti propius accedere. Nempe, si puncto B admoveatur Oculus, suo (ad lentem) ferè nativo in loco conspicitur punctum A (vel æquè distans, ad Speculum;) ad O reductus oculus ejusce speciem appropinquantem cernit; ad P adhuc vicinius ipsum existimat; ac ità sensim, donec alicubi tandem, velut ad Q, constituto oculo objectum summè propinquum apparens, in meram confusionem incipiat evanescere. Quæ sanè cuncta rationibus atque decretis nostris repugnare videntur, aut cum iis saltem parùm amicè conspirant. Neque nostram tantùm sententiam pulsant hoc experimentum; at ex æquo cæteras quas nôrim omnes; veterem imprimis ac vulgatam, nostræ præ reliquis affinem ità convellere videtur, ut ejus vi coactus doctissimus A. Tacquetus isti principio (cui penè soli totam inædificaverat Catoptricam suam) ceu infido ac inconstanti renunciârit, adeoque suam ipse doctrinam labefactârit; id tamen, opinor, minimè facturum, si rem totam inspexisset penitiùs, atque difficultatis fundum attigisset. Apud me verò non ità pollet hæc, nec eoûsque præpollebit ulla difficultas, ut ab iis quæ manifestè rationi consentanea video, discedam; præsertim quum ut hîc accidit, ejusmodi difficultas in singularis cujuspiam casûs disparitate fundetur. Nimirum in præsentem casu peculiare quiddam, naturæ subtilitati involutum, delitescit, ægrè fortassis, nisi perfectiùs explorato videndi modo, detegendum. Circa quod nil, fateor, hactenus excogitare potui, quod adblandiretur animo meo, nedum planè satisfaceret. Vobis itaque nodum hunc, utinam feliciore conatu, resolvendum committo.

*In English as follows.*

‘I have here delivered what my Thoughts have suggested to me, concerning that part of *Optics* which is more properly *Mathematical*. As for the other parts of that Science (which being rather *Physical*, do consequently abound with plausible Conjectures, instead of certain Principles) there has in them scarce any thing occur’d to my Observation, different from



what has been already said by *Kepler*, *Scheinerus*, *Descartes*, &c. And, methinks, I had better say nothing at all, than repeat that which has been so often said by others. I think it therefore high time to take my leave of this Subject. But before I quit it for good and all, the fair and ingenuous Dealing that I owe both to You and to Truth, obliges me to acquaint you with a certain untoward Difficulty, which seems directly opposite to the Doctrine I have been hitherto inculcating, at least, admits of no Solution from it. In short it is this. Before the double Convex Glass or Concave *Speculum* EBF, let the Point A be placed, at such a Distance that the Rays proceeding from A, after Refraction or Reflection, be brought to Unite somewhere in the Ax AB. And suppose the Point of Union (*i.e.* the Image of the Point A, as hath been already set forth) to be Z; between which and B, the *Vertex* of the Glass or *Speculum*, conceive the Eye to be any where placed. The Question now is, Where the Point A ought to appear. Experience shews that it doth not appear behind at the Point Z, and it were contrary to Nature that it shou'd; since all the Impression which affects the Sense comes from towards A. But from our Tenents it shou'd seem to follow, that it wou'd appear before the Eye at a vast Distance off, so great as shou'd in some Sort, surpass all sensible Distance. For since if we exclude all Anticipations and Prejudices, every *Object* appears by so much the farther off, by how much the Rays it sends to the Eye are less Diverging. And that *Object* is thought to be most remote, from which Parallel Rays proceed unto the Eye. Reason wou'd make one think, that *Object* shou'd appear, at yet a greater Distance, which is seen by converging Rays. Moreover it may in general be asked concerning this Case, what it is that determines the apparent Place of the Point A, and maketh it to appear after a constant manner, sometimes nearer, at other times farther off? To which doubt, I see nothing that can be answer'd agreeable to the Principles we have laid down, except only that the Point A ought always to appear extreamly remote. But on the contrary, we are assur'd by Experience that the Point A appears variously Distant, according to the different Situations of the Eye between the Points B and Z. And that it doth almost never (if at all) seem farther off, than it wou'd if it were beheld by the naked Eye, but on the contrary, it doth sometimes appear much nearer. Nay, it is even certain, that by how much the Rays falling on the Eye do more

converge, by so much the nearer does the *Object* seem to approach. For the Eye being placed close to the Point B, the *Object* A appears nearly in it's own natural Place, if the Point B is taken in the Glass, or at the same Distance, if in the *Speculum*. The Eye being brought back to O, the *Object* seems to draw near. And being come to P it beholds it still nearer. And so on by little and little, till at length the Eye being placed somewhere, suppose at Q, the *Object* appearing extremely near, begins to vanish into meer Confusion. All which doth seem Repugnant to our Principles, at least, not rightly to agree with them. Nor is our Tenent alone struck at by this Experiment, but likewise all others that ever came to my Knowledge are, every whit as much, endanger'd by it. The ancient one especially (which is most commonly receiv'd, and comes nearest to mine) seems to be so effectually overthrown thereby, that the most learned *Tacquet* has been forc'd to reject that Principle, as false and uncertain, on which alone he had built almost his whole *Catoptrics*, and consequently by taking away the Foundation, hath himself pulled down the Superstructure he had raised on it. Which nevertheless, I do not believe he wou'd have done, had he but consider'd the whole matter more thoroughly, and examin'd the Difficulty to the bottom. But as for me, neither this, nor any other Difficulty shall have so great an Influence on me, as to make me renounce that which I know to be manifestly agreeable to Reason. Especially when, as it here falls out, the Difficulty is founded in the peculiar Nature of a certain odd and particular Case. For in the present Case something peculiar lies hid, which being involv'd in the Subtilty of Nature will, perhaps, hardly be discover'd till such Time, as the manner of *Vision* is more perfectly made known. Concerning which, I must own, I have hitherto been able to find out nothing that has the least shew of *Probability*, not to mention *Certainty*. I shall therefore, leave this Knot to be untied by you, wishing you may have better Success in it than I have had.'

XXX. The ancient and receiv'd Principle which Dr. *Barrow* here mentions, as the main Foundation of *Tacquet's* *Catoptrics*, is that, *every visible Point seen by Reflexion from a Speculum, shall appear placed at the Intersection of the reflected Ray, and the Perpendicular of Incidence*. Which Intersection in the present Case, happening to be behind the Eye, it greatly shakes the Authority of that Principle, whereon the aforementioned Author proceeds throughout his whole *Catoptrics*, in determining the apparent Place of *Objects* seen by Reflexion from any kind of *Speculum*.

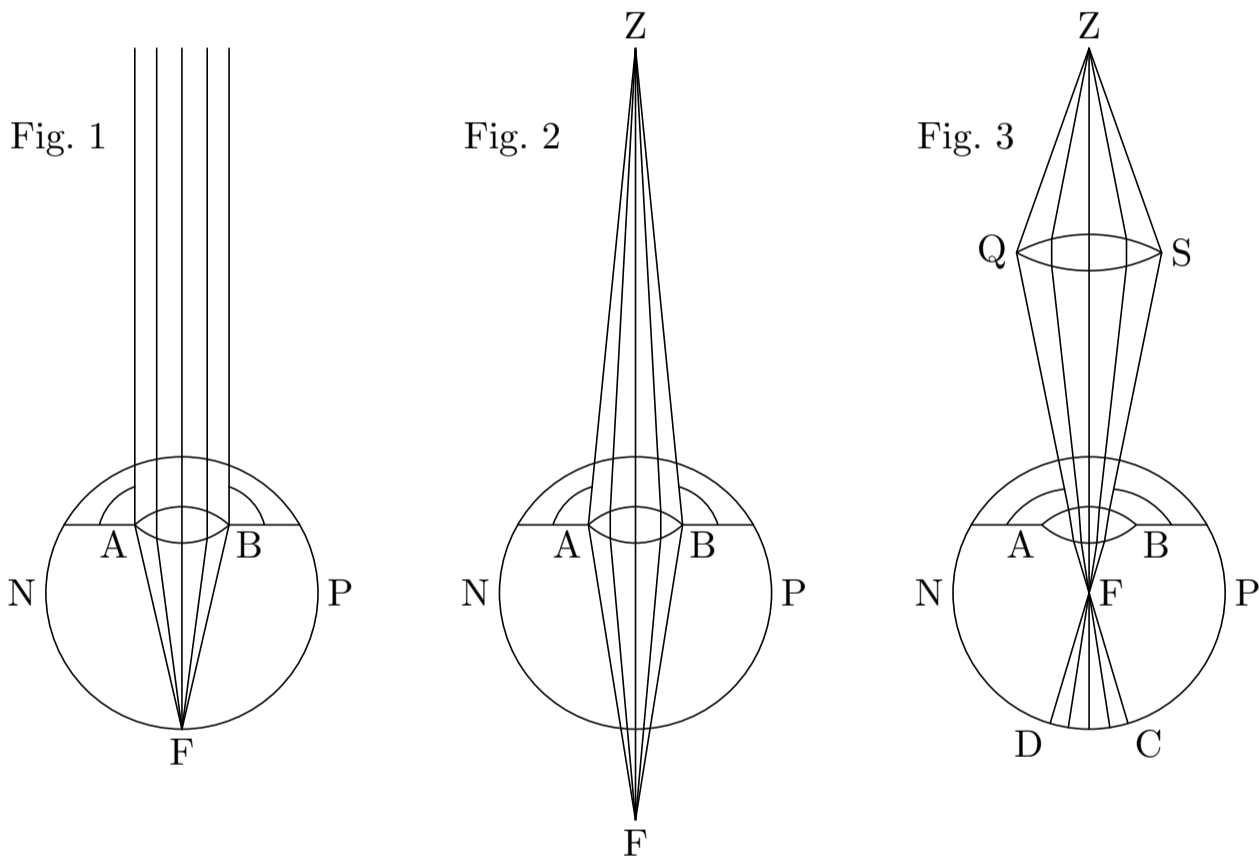
XXXI. Let us now see how this *Phænomenon* agrees with our Tenents. The Eye the nearer it is placed to the Point B in the above Figures, the more distinct is the Appearance of the *Object*; but as it recedes to O, the Appearance grows more Confused; and at P it sees the *Object* yet more Confused; and so on till the Eye being brought back to Z sees the *Object* in the greatest Confusion of all. Wherefore by *Sect. XXI.* the *Object* shou'd seem to approach the Eye gradually, as it recedes from the Point B, *viz.* at O it shou'd (in consequence of the Principle I have laid down in the aforesaid *Section*) seem nearer than it did at B, and at P nearer than at O, and at Q nearer than at P; and so on, till it quite vanishes at Z. Which is the very matter of Fact, as any one that pleases may easily satisfie himself by Experiment.

XXXII. This Case is much the same, as if we shou'd suppose an *English-man* to meet a Foreigner, who used the same Words with the *English*, but in a direct contrary Signification. The *English-man* wou'd not fail to make a wrong Judgment, of the *Ideas* annexed to those Sounds, in the Mind of him that used them. Just so, in the present Case the *Object* speaks (if

I may so say) with Words that the Eye is well acquainted with, *viz.* Confusions of Appearance; but whereas heretofore the greater Confusions were always wont to signifie nearer Distances, they have in this Case a direct, contrary Signification, being connected with the greater Distances. Whence it follows, that the Eye must unavoidably be mistaken, since it will take the Confusions in the Sense it has been used to, which is directly opposed to the True.

XXXIII. This *Phænomenon* as it entirely subverts the Opinion of those, who will have us judge of Distance by Lines and Angles, on which Supposition it is altogether inexplicable, so it seems to me no small Confirmation, of the Truth of that Principle whereby it is explain'd. But in order to a more full Explication of this Point, and to shew how far the *Hypothesis* of the Mind's judging, by the various Divergency of Rays, may be of use in determining the apparent Place of an *Object*, it will be necessary to premise some few Things, which are already well known to those who have any Skill in *Dioptrics*.

XXXIV. *First*, any radiating Point is then distinctly seen, when the Rays proceeding from it are, by the refractive Power of the Crystalline, accurately reunited in the *Retina*, or Fund of the Eye. But if they are reunited, either before they arrive at the *Retina*, or after they have past it, then there is confused Vision.



XXXV. *Secondly*, Suppose in the adjacent Figures NP represent an Eye duly framed, and retaining its natural Figure. In *Fig. 1.* the Rays falling nearly Parallel on the Eye, are by the Crystalline AB refracted, so as their *Focus*, or Point of Union F falls exactly on the

*Retina*. But if the Rays fall sensibly diverging on the Eye, as in *Fig. 2.* then their *Focus* falls beyond the *Retina*: Or if the Rays are made to converge by the *Lens* QS, before they come at the Eye, as in *Fig. 3.* their *Focus* F will fall before the *Retina*. In which two last Cases, 'tis evident from the foregoing *Section*, that the Appearance of the Point Z is confused. And by how much the greater is the Convergency, or Divergency of the Rays falling on the *Pupil*, by so much the farther will the Point of their reunion be from the *Retina*, either before or behind it, and consequently the Point Z will appear, by so much, the more Confused. And this, by the *Bye*, may shew us the difference between Confused, and Faint Vision. Confused Vision is, when the Rays proceeding from each distinct Point of the *Object*, are not accurately recollected in one corresponding Point on the *Retina*; but take up some Space thereon. So that Rays from different Points become mix'd, and confused together. This is oppos'd to distinct Vision, and attends near *Objects*. Faint Vision is, when by reason of the Distance of the *Object*, or grossness of the interjacent *Medium*, few Rays arrive from the *Object* to the Eye. This is oppos'd to vigorous, or clear Vision, and attends remote *Objects*. But to return.

XXXVI. The Eye, or (to speak truly) the Mind perceiving only the Confusion it self, without ever considering the Cause from which it proceeds, doth constantly annex the same Degree of Distance, to the same Degree of Confusion. Whether that Confusion be occasion'd by Converging, or by Diverging Rays, it matters not. Whence it follows, that the Eye viewing the *Object* Z thro' the Glass QS (which by Refraction causeth the Rays ZQ, ZS, &c. to converge) shou'd judge it to be at such a Nearness, at which if it were placed, it wou'd radiate on the Eye with Rays diverging to that Degree, as wou'd produce the same Confusion, which is now produced by Converging Rays, *i. e.* wou'd cover a Portion of the *Retina* equal to DC. *vid. Fig. 3. Sup.* But then this must be understood (to use Dr. *Barrow's* Phrase) *Seclusis prænotionibus & præjudiciis*, In case, we abstract from all other Circumstances of Vision, such as the Figure, Size, Faintness, &c. of the visible *Objects*; all which do ordinarily concur to form our *Idea* of Distance; the Mind having, by frequent Experience, observed their several Sorts or Degrees, to be connected with various Distances.

XXXVII. It plainly follows from what has been said, that a Person perfectly Purbblind (*i. e.* that cou'd not see an *Object* distinctly, but when placed close to his Eye) wou'd not make the same wrong Judgment that others do, in the foremention'd Case. For, to him, greater Confusions constantly suggesting greater Distances, he must, as he recedes from the Glass, and the *Object* grows more Confus'd, judge it to be at a farther Distance, contrary to what they do, who have had the Perception of the *Object's* growing more Confused, connected with the *Idea* of Approach.

XXXVIII. Hence also it doth appear, there may be good use of computation by Lines and Angles in *Optics*; not, that the Mind judges of Distance immediately by them, but because it judges by somewhat which is connected with them, and to the determination whereof, they may be subservient. Thus the Mind judging of the Distance of an *Object*, by the Confusedness of it's Appearance; and this Confusedness being greater or lesser to the naked Eye, according as the *Object* is seen by Rays more, or less Diverging; it follows, that a Man may make use of the Divergency of the Rays, in computing the apparent Distance, tho' not for it's own sake, yet on account of the Confusion with which it is connected. But, so it is, the Confusion it self is entirely neglected by *Mathematicians*, as having no necessary relation with Distance, such



as the greater or lesser Angles of Divergency are conceiv'd to have. And these (especially for that they fall under *Mathematical* Computation) are alone regarded, in determining the apparent Places of *Objects*, as tho' they were the sole and immediate Cause of the Judgments the Mind makes of Distance. Whereas, in Truth, they shou'd not at all be regarded in themselves, or any otherwise, than as they are supposed to be the Cause of Confused Vision.

XXXIX. The not considering of this has been a fundamental and perplexing Oversight. For Proof whereof, we need go no farther than the Case before us. It having been observed, that the most Diverging Rays brought into the Mind the *Idea* of nearest Distance, and that still, as the Divergency decreas'd, the Distance increas'd; and it being thought, the connexion between the various Degrees of Divergency, and Distance, was immediate; this naturally leads one to conclude, from an ill grounded Analogy, that Converging Rays shall make an *Object* appear at an immense Distance: And that, as the Convergency increases, the Distance (if it were possible,) shou'd do so likewise. That this was the Cause of Dr. *Barrow's* Mistake, is evident from his own Words which we have Quoted. Whereas, had the learned Doctor observ'd, that Diverging and Converging Rays, how opposite soever they may seem, do nevertheless agree in producing the same effect, *viz. Confusedness of Vision*, greater Degrees whereof are produced indifferently, either as the Divergency, or Convergency of the Rays increaseth. And that it is by this effect, which is the same in both, that either the Divergency, or Convergency is perceived by the Eye. I say, had he but consider'd this, 'tis certain he wou'd have made a quite contrary Judgment, and rightly concluded, that those Rays which fall on the Eye with greater degrees of Convergency shou'd make the *Object* from whence they proceed, appear by so much the nearer. But 'tis plain, it was impossible for any Man to attain to a right Notion of this Matter, so long as he had regard only to Lines and Angles; and did not apprehend the true Nature of *Vision*, and how far it was of *Mathematical* Consideration.

XL. Before we dismiss this Subject, 'tis fit we take Notice of a Query, relating thereto, proposed by the Ingenious Mr. *Molyneux*, in his Treatise of *Dioptrics*, *Par. 1. Prop. 31. Sect. 9.* where speaking of the Difficulty we have been explaining, he has these Words, 'And so he (*i. e.* Dr. *Barrow*) leaves this Difficulty to the Solution of Others, which I (after so great an Example) shall do likewise; but with the Resolution of the same admirable Author of not quitting the evident Doctrine which we have before laid down, for determining the *Locus Objecti*, on account of being Press'd by one Difficulty, which seems inexplicable till a more intimate Knowledge of the Visive Faculty be obtain'd by Mortals. In the mean time, I propose it to the Consideration of the Ingenious, Whether the *Locus Apparens* of an *Object* placed as in this 9th *Section*, be not as much before the Eye, as the distinct Base is behind the Eye?' To which Query we may venture to answer in the Negative. For in the present Case, the Rule for determining the Distance of the distinct Base, or respective *Focus* from the Glass, is this. *As the difference between the Distance of the Object and Focus : is to the Focus or Focal Length :: So the Distance of the Object from the Glass : to the Distance of the respective Focus or Distinct Base from the Glass. Vid. Molyneux Diopt. Par. 1. Prop. 5.* Let us now suppose the *Object* to be placed at the Distance of the Focal Length, and one half of the Focal Length from the Glass, and the Eye close to the Glass. Hence it will follow by the Rule, that the Distance of the Distinct Base behind the Eye is double the true Distance of the *Object* before the Eye. If therefore Mr. *Molyneux's* Conjecture held good, it wou'd

follow, that the Eye shou'd see the *Object*, twice as far off as it really is. And in other Cases, at three or four times it's due Distance or more. But this manifestly contradicts Experience; the *Object* never appearing, at farthest, beyond its due Distance. Whatever therefore is built on this Supposition (*vid. Corol. 1. Prop. 57. ibid.*) comes to the Ground along with it.

XLI. From what hath been premis'd, it is a manifest Consequence, that a Man Born Blind, being made to see wou'd at first, have no *Idea* of Distance by Sight. The Sun and Stars, the remotest *Objects* as well as the nearer wou'd all seem to be in his Eye, or rather in his Mind. The *Objects* intromitted by Sight, wou'd seem to him (as in truth they are) no other than a new Set of Thoughts or Sensations, each whereof is as near to him, as the Perceptions of Pain or Pleasure, or the most inward Passions of his Soul. For our judging *Objects* perceiv'd by Sight to be at any Distance, or without the Mind, is (*vid. Sect. XXVIII.*) intirely the effect of Experience, which one in those Circumstances cou'd not yet have attained to.

XLII. It is indeed otherwise upon the common Supposition, that Men judge of Distance by the Angle of the *Optic Axes*, just as one in the Dark, or a Blind-Man by the Angle comprehended by two Sticks, one whereof he held in each Hand. For if this were true, it wou'd follow that one Blind from his Birth, being made to See, shou'd stand in need of no new Experience, in order to perceive Distance by Sight. But that this is False, has, I think, been sufficiently demonstrated.

XLIII. And perhaps, upon a strict Inquiry we shall not find, that even those, who from their Birth have grown up in a continu'd Habit of Seeing, are irrecoverably prejudiced on the other side, *viz.* in thinking what they See to be at a Distance from them. For at this time it seems agreed on all Hands, by those who have had any thoughts of that Matter, that Colours, which are the proper and immediate *Object* of Sight, are not without the Mind. But then say you, by Sight we have also the *Ideas* of Extension, and Figure, and Motion; all which may well be thought without, and at some Distance from the Mind, tho' Colour shou'd not. In answer to this, I appeal to any Man's Experience, whether the visible Extension of any *Object* do not appear as near to him, as the Colour of that *Object*; Nay, whether they do not both seem to be in the very same Place. Is not the Extension we see Colour'd, and is it possible for us, so much as in Thought, to separate and abstract Colour from Extension? Now, where the Extension is, there surely is the Figure, and there the Motion too. I speak of those which are perceiv'd by Sight.

XLIV. But for a fuller Explication of this Point, and to shew that the immediate *Objects* of Sight are not so much as the *Ideas* or Resemblances of things placed at a Distance, 'tis requisite we look nearer into the Matter, and carefully observe what is meant in common Discourse, when one says, that which he sees is at a Distance from him. Suppose, for Example, That looking at the Moon I shou'd say, it were Fifty or Sixty Semidiameters of the Earth distant from me. Let us see what Moon this is spoken of. 'Tis plain it cannot be the visible Moon, or any thing like the visible Moon, or that which I see, which is only a round, luminous Plain, of about Thirty visible Points in Diameter. For in case I am carry'd, from the place where I stand directly towards the Moon; 'tis manifest the *Object* varies, still as I go on; and by the time that I am advanced Fifty or Sixty Semidiameters of the Earth, I shall be so far from being near a small, round, luminous Flat, that I shall perceive nothing like it; this

*Object* having long since disappear'd, and if I wou'd recover it, it must be by going back to the Earth from whence I set out. Again, Suppose I perceive by Sight the faint and obscure *Idea* of something, which I doubt whether it be a Man, or a Tree, or a Tower; but judge it to be at the Distance of about a Mile. 'Tis plain I cannot mean, that what I see is a Mile off, or that it is the Image or Likeness of any thing which is a Mile off. Since that every Step I take towards it, the Appearance alters, and from being Obscure, Small, and Faint grows, Clear, Large, and Vigorous. And when I come to the Mile's end, that which I saw first is quite lost, neither do I find any thing in the likeness of it.

XLV. In these, and the like Instances, the truth of the Matter, I find, stands thus. Having of a long time, experienced certain *Ideas*, perceivable by Touch, as Distance, Tangible Figure, and Solidity to have been connected with certain *Ideas* of Sight, I do upon perceiving these *Ideas* of Sight, forthwith conclude what Tangible *Ideas* are, by the wonted, ordinary course of Nature like to follow. Looking at an *Object* I perceive a certain Visible Figure, and Colour with some degree of Faintness and other Circumstances; which, from what I have formerly observ'd, determin me to think, that if I advance forward so many Paces, Miles, &c. I shall be affected with such, and such *Ideas* of Touch. So that in truth, and strictness of Speech, I neither see Distance it self, nor any thing that I take to be at a Distance. I say, neither Distance, nor things placed at a Distance are themselves, or their *Ideas*, truly perceiv'd by Sight. This I am perswaded of, as to what concerns my self. And I believe whoever will look narrowly into his own Thoughts, and examin what he means by saying, he sees this, or that thing at a Distance, will agree with me that, what he sees only suggests to his Understanding, that after having passed a certain Distance, to be measur'd by the Motion of his Body, which is perceivable by Touch, he shall come to perceive such, and such Tangible *Ideas* which have been usually connected with such and such Visible *Ideas*. But that one might be deceived by these suggestions of Sense, and that there is no necessary Connexion, between Visible, and Tangible *Ideas* suggested by them, we need go no farther than the next Looking-Glass or Picture, to be convinced. Note, that when I speak of Tangible *Ideas*, I take the Word *Idea* for any the immediate *Object* of Sense, or Understanding, in which large Signification it is commonly used by the Moderns.

XLVI. From what we have shewn it is a manifest Consequence, that the *Ideas* of Space, Outness, and things placed at a Distance are not, strictly speaking, the *Object* of Sight. They are no otherwise perceived by the Eye, than by the Ear. Sitting in my Study I hear a Coach drive along the Streets. I look through the Casement and see it. I walk out and enter into it. Thus, common Speech wou'd incline one to think, I heard, saw, and touch'd the same Thing, *viz.* the Coach. It is, nevertheless, certain, the *Ideas* intromitted by each Sense are widely different, and distinct from each other; but having been observed constantly to go together, they are spoken of as one and the same thing. By the variation of the Noise, I perceive the different Distances of the Coach, and know that it approaches before I look out. Thus by the Ear I perceive Distance, just after the same manner, as I do by the Eye.

XLVII. I do not, nevertheless, say I hear Distance, in like manner as I say that I see it, the *Ideas* perceiv'd by Hearing not being so apt to be confounded with the *Ideas* of Touch, as those of Sight are. So likewise, a Man is easily convinced that Bodies, and external Things are not properly the *Object* of Hearing, but only Sounds, by the Mediation whereof the *Idea* of this or that Body, or Distance is suggested to his Thoughts. But then one is with more

difficulty, brought to discern the difference there is betwixt the *Ideas* of Sight and Touch: Tho' it be certain, a Man no more Sees and Feels the same Thing, than he Hears and Feels the same Thing.

XLVIII. One Reason of which seems to be this. It is thought a great Absurdity to imagine that one, and the same thing, shou'd have any more than one Extension, and one Figure. But the Extension and Figure of a Body, being let into the Mind two ways, and that indifferently, either by Sight, or Touch, it seems to follow that we see the same Extension, and the same Figure which we Feel.

XLIX. But if we take a close and accurate View of the Matter, it must be acknowledg'd, that we never See and Feel one and the same thing. That which is Seen is one thing, and that which is felt is another. If the Visible Figure and Extension be not the same, with the Tangible Figure and Extension, we are not to infer, that one and the same thing has divers Extensions. The true Consequence is, that *the Objects of Sight and Touch are two distinct things*. It may perhaps, require some Thought, rightly to conceive this Distinction. And the difficulty seems not a little increas'd, because the Combination of Visible *Ideas* hath constantly the same Name, as the Combination of Tangible *Ideas* wherewith it is connected. Which does of necessity arise from the use, and end of Language.

L. In order therefore to treat accurately, and unconfusedly of *Vision*, we must bear in Mind, that there are two sorts of *Objects* apprehended by the Eye: The one, primarily and immediately, the other, secondarily and by intervention of the former. Those of the first sort neither are, nor appear to be without the Mind, or at any distance off. They may, indeed, grow Greater, or Smaller, more Confused, or more Clear, or more Faint. But, they do not, cannot Approach, or Recede from us. Whenever we say an *Object* is at a Distance, whenever we say, it draws near, or goes farther off; we must always mean it of the latter sort, which properly belong to the *Touch*, and are not so truly perceived, as suggested, by the Eye, in like manner as Thoughts by the Ear.

LI. No sooner do we hear the Words of a familiar Language pronounced in our Ears, but the *Ideas* corresponding thereto present themselves to our Minds. In the very same instant, the Sound and the Meaning enter the Understanding. So closely are they United, that 'tis not in our Power to keep out the one, except we exclude the other also. We even act in all respects, as tho' we heard the very Thoughts themselves. So likewise, the Secondary *Objects*, or those which are only suggested by Sight, do often more strongly affect us, and are more regarded than the proper *Objects* of that Sense; along with which they enter into the Mind, and with which they have a far more strict and near Connexion, than *Ideas* have with Words. Hence it is, we find it so difficult to discriminate, between the immediate and mediate *Objects* of Sight, and are so prone to attribute to the former, what belongs only to the latter. They are, as it were, most closely twisted, blended, and incorporated together. And the Prejudice is confirm'd, and riveted in our Thoughts, by a long tract of Time, by the use of Language, and want of Reflexion. However, I doubt not, but any one that shall attentively consider what we have already said, and shall say upon this Subject before we have done, (especially if he pursue it in his own Thoughts) may be able to deliver himself from that Prejudice. Sure I am, 'tis worth some Attention, to whoever wou'd understand the true nature of *Vision*.

LII. I have now done with Distance, and proceed to shew, how it is, that we perceive by Sight, the Magnitude of Objects. It is the Opinion of some, that we do it by Angles, or by Angles in Conjunction with Distance. But neither Angles, nor Distance being perceivable by Sight: and the things we see being, in truth, at no Distance from us; it follows, that as we have demonstrated Lines and Angles not to be the *Medium*, the Mind makes use of in apprehending the Apparent Place, so neither are they, the *Medium* whereby it apprehends the Apparent Magnitude of Objects.

LIII. It is well known that the same Extension, at a near Distance, shall subtend a greater Angle, and at a farther Distance, a lesser Angle. And by this Principle (we are told) the Mind estimates the Magnitude of an *Object*, comparing the Angle under which it is seen, with its Distance, and thence inferring the Magnitude thereof. What inclines Men to this Mistake (beside the Humour of making one see by *Geometry*) is, that the same Perceptions or *Ideas* which suggest Distance, do also suggest Magnitude. But if we examine it, we shall find they suggest the latter, as immediately as the former. I say, they do not first suggest Distance, and then leave it to the Judgment to use that as a *Medium*, whereby to collect the Magnitude; but they have as close, and immediate a Connexion with the Magnitude, as with the Distance; and suggest Magnitude as independently of Distance, as they do Distance independently of Magnitude. All which will be evident, to whoever considers what has been already said, and what follows.

LIV. It has been shewn, there are two sorts of *Objects* apprehended by Sight; each whereof hath its distinct Magnitude, or Extension. The one, properly Tangible, *i. e.* to be perceiv'd and measur'd by Touch, and not immediately falling under the Sense of Seeing. The other, properly and immediately Visible, by Mediation of which, the former is brought in View. Each of these Magnitudes are greater or lesser, according as they contain in them more or fewer Points; they being made up of Points or *Minimums*. For, whatever may be said of Extension in *Abstract*, it is certain sensible Extension is not infinitely Divisible. There is a *Minimum Tangibile*, and a *Minimum Visibile*, beyond which Sense cannot perceive. This, every ones Experience will inform him.

LV. The Magnitude of the *Object* which exists without the Mind, and is at a Distance, continues always invariably the same. But the Visible *Object* still changing as you approach to, or recede from the Tangible *Object*, it hath no fixed and determinate Greatness. Whenever therefore, we speak of the Magnitude of any thing, for Instance a *Tree* or a *House*, we must mean the Tangible Magnitude, otherwise there can be nothing steady, and free from Ambiguity spoken of it. Now, tho' the Tangible and Visible Magnitude do, in truth, belong to two distinct Objects: I shall nevertheless (especially since those Objects are called by the same Name, and are observ'd to coexist) to avoid tediousness and singularity of Speech, sometimes speak of them, as belonging to one and the same thing.

LVI. Now in order to discover by what means, the Magnitude of Tangible Objects is perceived by Sight; I need only reflect on what Passes in my own Mind. And observe what those things be, which introduce the *Ideas* of *greater* or *lesser* into my Thoughts, when I look on any *Object*. And these I find to be, First, the Magnitude or Extension of the Visible *Object*, which being immediately perceived by Sight, is connected with that other which is Tangible, and placed at a Distance. Secondly, The Confusion or Distinctness. And, Thirdly,

The Vigorousness or Faintness of the aforesaid Visible Appearance. *Cæteris paribus*, by how much the greater or lesser, the Visible *Object* is, by so much the greater or lesser, do I conclude the Tangible *Object* to be. But, be the *Idea* immediately perceived by Sight never so large, yet if it be withal Confused, I judge the Magnitude of the thing to be but small. If it be Distinct and Clear, I judge it greater. And if it be Faint, I apprehend it to be yet greater. What is here meant, by Confusion and Faintness, has been Explain'd in *Sect. XXXV*.

LVII. Moreover, the Judgments we make of Greatness do, in like manner as those of Distance, depend on the Disposition of the Eyes, also on the Figure, Number of intermediate Objects, and other Circumstances that have been observ'd to attend great, or small Tangible Magnitudes. Thus, for Instance, The very same Quantity of Visible Extension, which in the Figure of a Tower, doth suggest the *Idea* of great Magnitude, shall, in the Figure of a Man, suggest the *Idea* of much smaller Magnitude. That this is owing to the Experience we have had, of the usual Bigness of a Tower and a Man, no one, I suppose, need be told.

LVIII. It is also evident, that Confusion, Faintness, &c. have no more a necessary Connexion with little or great Magnitude, than they have with little or great Distance. As they suggest the latter, so they suggest the former to our Minds. And, by Consequence, if it were not for *Experience*, we shou'd no more judge a faint or confused Appearance to be connected, with great or little Magnitude, than we shou'd that it was connected with great or little Distance.

LIX. Nor will it be found, that great or small Visible Magnitude hath any necessary Relation to great or small Tangible Magnitude: So that the one may certainly, and infallibly be infer'd from the other. But, before we come to the Proof of this, 'tis fit we consider the difference there is, betwixt the Extension and Figure which is the proper Object of *Touch*, and that other which is termed *Visible*; and how the former is principally, tho' not immediately, taken notice of, when we look at any *Object*. This has been before mention'd, but we shall here enquire into the Cause thereof. We regard the Objects that environ us, in proportion as they are adapted to benefit, or injure our own Bodies, and thereby, produce in our Minds the Sensations of Pleasure, or Pain. Now Bodies operating on our Organs, by an immediate Application: And the Hurt and Advantage arising there-from, depending altogether on the Tangible, and not at all on the Visible, Qualities of any Object: This is a plain Reason, why those shou'd be regarded by us as much more than these. And for this End, chiefly, the *Visive Sense* seems to have been bestowed on Animals, *viz.* that by the Perception of Visible *Ideas* (which in themselves are not capable of affecting, or in any wise altering the Frame of their Bodies) they may be able to foresee (from the Experience they have had, what Tangible *Ideas* are connected with such, and such Visible *Ideas*) the Damage or Benefit which is like to ensue, upon the Application of their own Bodies to this, or that Body which is at a Distance. Which Foresight, how necessary it is to the preservation of an Animal, every ones Experience can inform him. Hence it is, that when we look at an *Object*, the Tangible Figure and Extension thereof are principally attended to; whilst there is small heed taken of the Visible Figure and Magnitude, which, tho' more immediately perceiv'd, do less sensibly affect us, and are not fitted to produce any Alteration in our Bodies.

LX. That the Matter of Fact is true, will be evident to any one, who considers that a Man placed at Ten Foot Distance, is thought as great, as if he were placed at the Distance

only of Five Foot; which is true, not with Relation to the Visible, but Tangible greatness of the *Object*: The Visible Magnitude being far greater, at one Station, than it is at the other.

LXI. Inches, Feet, &c. are settled, stated Lengths, whereby we measure Objects, and estimate their Magnitude, we say, for Example, an *Object* appears to be Six Inches, or Six Foot long. Now, that this cannot be meant of Visible Inches, &c. is evident, because a Visible Inch is it self no constant, determinate Magnitude, and cannot therefore, serve to mark out, and determin the Magnitude of any other thing. Take an Inch mark'd upon a Ruler; view it, successively, at the Distance of Half a Foot, a Foot, a Foot and a Half, &c. from the Eye; at each of which, and at all the intermediate Distances, the Inch shall have a different Visible Extension, *i. e.* there shall be more or fewer Points discerned in it. Now I ask which of all these various Extensions, is that Stated, determinate one, that is agreed on, for a common Measure of other Magnitudes? No reason can be assign'd, why we shou'd pitch on one, more than another. And except there be some invariable, determinate Extension fixed on, to be mark'd by the Word *Inch*, 'tis plain, it can be used to little Purpose; and to say, a Thing contains this or that Number of *Inches*, shall imply no more than that it is extended, without bringing any particular *Idea* of that Extension into the Mind. Farther, an Inch and a Foot, from different Distances, shall both exhibit the same Visible Magnitude, and yet at the same time, you shall say, that one seems several times greater than the other. From all which it is manifest, that the Judgments we make of the Magnitude of Objects by Sight, are altogether in reference to their Tangible Extension. Whenever we say an *Object* is Great, or Small, of this or that determinate Measure, I say, it must be meant of the Tangible, and not the Visible Extension, which, tho' immediately perceiv'd, is nevertheless little taken Notice of.

LXII. Now, that there is no necessary Connexion, between these two Distinct Extensions is evident from hence. Because our Eyes might have been framed in such a manner, as to be able to see nothing but what were less than the *Minimum Tangibile*. In which Case, it's not impossible we might have perceived all the Immediate Objects of Sight, the very same that we do now. But unto those Visible Appearances, there wou'd not be Connected those different Tangible Magnitudes, that are now. Which shews, the Judgments we make of the Magnitude of Things placed at a Distance, from the various Greatness of the Immediate Objects of Sight, do not arise from any Essential or Necessary, but only a Customary Tye, which has been observ'd betwixt them.

LXIII. Moreover, it is not only certain, that any *Idea* of Sight might not have been Connected, with this or that *Idea* of Touch, we now observe to accompany it: But also, that the greater Visible Magnitudes might have been Connected with, and Introduced into our Minds, lesser Tangible Magnitudes, and *Vice Versa*. Nay, that it often is so, we have daily Experience; that *Object* which makes a strong and large Appearance, not seeming near so great, as another the Visible Magnitude whereof is much less, but more faint.

LXIV. From which, and from *Sect.* LVII, and LVIII. it is manifest, that as we do not perceive the Magnitude of Objects immediately by Sight, so neither do we perceive them, by the Mediation of any thing which has a necessary Connexion with them. Those *Ideas* that now suggest unto us, the various Magnitudes of External Objects, before we touch them, might possibly have suggested no such thing: Or they might have signified them, in a direct, contrary manner, so that the very same *Ideas*, on the Perception whereof we judge an *Object*

to be small, might as well have serv'd to make us conclude it great. Those *Ideas* being in their own Nature, equally fitted to bring into our Minds the *Idea* of Small, or Great, or no Size at all of outward Objects. Just as the Words of any Language are in their own Nature, indifferent to signifie this, or that thing, or nothing at all.

LXV. As we see Distance, so we see Magnitude. And we see both, in the same way that we see Shame or Anger, in the Looks of a Man. Those Passions are themselves Invisible, they are nevertheless let in by the Eye along with Colours, and alterations of Countenance, which are the immediate *Object* of *Vision*: And which signifie them for no other Reason, than barely because they have been observ'd to accompany them. Without which Experience, we shou'd no more have taken Blushing for a Sign of Shame, than of Gladness.

LXVI. We are nevertheless exceeding Prone to imagine, those things which are perceived only by the Mediation of others, to be themselves the immediate Objects of Sight: Or, at least, to have in their own Nature a Fitness to be suggested by them, before ever they had been experienced to Coexist with them. From which prejudice every one, perhaps, will not find it easy to emancipate himself, by any the clearest Convictions of Reason. And there are some Grounds to think, that if there was one only invariable, and universal Language in the World, and that Men were born with the Faculty of speaking it; it wou'd be the Opinion of some, that the *Ideas* in other Mens Minds were properly perceived by the Ear, or had at least a necessary and inseparable Tye with the Sounds that were affixed to them. All which seems to arise, from a want of a due Application of our Discerning Faculty, thereby to Discriminate between the *Ideas* that are in our Understandings, and consider them apart from each other; which wou'd preserve us from confounding those that are different, and make us to see what *Ideas* do, and what do not include, or imply this or that other *Idea*.

LXVII. There is a Celebrated *Phænomenon*, the Solution whereof I shall attempt to give, by the Principles that have been laid down, in reference to the manner wherein we apprehend by Sight, the Magnitude of Objects. It is as follows. The apparent Magnitude of the Moon when placed in the *Horizon*, is much greater than when it is in the *Meridian*. Tho' the Angle under which the Diameter of the Moon is seen, be not observ'd greater in the former Case, than in the latter. Moreover, the Horizontal Moon doth not constantly appear of the same Bigness, but at some times seemeth far greater than at others.

LXVIII. Now in order to explicate the reason, of the Moon's appearing greater than ordinary in the *Horizon*; it must be observ'd, that the Particles which compose our Atmosphære, do intercept the Rays of Light, proceeding from any *Object* to the Eye; and by how much the greater is the Portion of Atmosphære, interjacent between the *Object* and the Eye, by so much the more are the Rays intercepted; and by consequence, the Appearance of the *Object* render'd more Faint: Every *Object* appearing more Vigorous or more Faint, in Proportion as it sendeth more or fewer Rays unto the Eye. Now, between the Eye, and the Moon, when situated in the *Horizon*, there lies a far greater Quantity of Atmosphære, than there does when the Moon is in the *Meridian*. Whence it comes pass, that the Appearance of the Horizontal Moon is fainter, and therefore by *Sect. LVI*, it shou'd be thought bigger in that Situation, than in the *Meridian*, or in any other Elevation above the *Horizon*.

LXIX. Farther, the Air being variously impregnated, sometimes more and sometimes less, with Vapours and Exhalations fitted to retund and intercept the Rays of Light; it follows,



that the Appearance of the Horizontal Moon hath not always an equal Faintness; and by Consequence, that Luminary, tho' in the very same Situation, is at one time judged greater than at another.

LXX. That we have here given the true Account of the *Phænomena* of the Horizontal Moon, will, I suppose, be farther Evident to any one from the following Considerations. *First*, 'Tis plain, that which in this Case suggests the *Idea* of greater Magnitude, must be something which is it self perceiv'd; for, that which is unperceiv'd cannot suggest to our Perception any other thing. *Secondly*, It must be something that does not constantly remain the same, but is subject to some Change or Variation, since the Appearance of the Horizontal Moon varies, being at one time greater than at another. *Thirdly*, It must not lie in the External Circumjacent or Intermediate Objects but be an Affection of the very Visible Moon it self: Since by looking thro' a Tube, when all other Objects are excluded from Sight, the Appearance is as great as ever. And yet, *Fourthly*, It cannot be the Visible Figure or Magnitude, since that remains the same, or is rather lesser, by how much the Moon is nearer to the *Horizon*. It remains therefore, that the true Cause is that Affection or Alteration of the Visible Appearance, which proceeds from the greater Paucity of Rays arriving at the Eye, and which I term *Faintness*: Since this answers all the foremention'd Conditions, and I am not conscious of any other Perception that does.

LXXI. Add to this, that in misty Weather it is a common Observation, that the Appearance of the Horizontal Moon is far larger than usual, which greatly conspires with, and strengthens our Opinion. Neither wou'd it prove, in the least, Irreconcilable with what we have said: If the Horizontal Moon shou'd chance sometime to seem enlarged beyond its usual Extent, even in more Serene Weather. For we must not only have regard to the Mist, which happens to be in the place where we stand; we ought also to take into our Thoughts, the whole Sum of Vapours and Exhalations, which lie betwixt the Eye and the Moon: All which cooperating to render the Appearance of the Moon more Faint, and thereby increase it's Magnitude, it may chance to appear greater than it usually does, even in the Horizontal Position, at a time when, tho' there be no extraordinary Fog or Haziness, just in the place where we stand, yet, the Air between the Eye and the Moon, taken all together, may be loaded with a greater quantity of interspersed Vapours and Exhalations, than at other times.

LXXII. It may be Objected, That in Consequence of our Principles, the Interposition of a Body in some degree Opaque, which may Intercept a great Part of the Rays of Light, shou'd render the Appearance of the Moon in the *Meridian* as large, as when it is viewed in the *Horizon*. To which I answer, 'tis not Faintness any how apply'd, that suggests greater Magnitude. There being no necessary, but only an experimental Connexion between those two things: It follows, that the Faintness, which enlarges the Appearance, must be applied in such Sort, and with such Circumstances, as have been observed to attend the Vision of great Magnitudes. When from a Distance (I speak with the Vulgar) we behold great Objects, the Particles of the intermediate Air and Vapours, which are themselves unperceivable, do interrupt the Rays of Light, and thereby render the Appearance less Strong and Vivid; now, Faintness of Appearance caused in this Sort, hath been experienced to coexist with great Magnitude. But, when it is caused by the Interposition of an Opaque, sensible Body, this Circumstance alters the Case; so that a Faint Appearance this way caused, does not suggest greater Magnitude, because it hath not been experienced to coexist with it.

LXXIII. Faintness, as well as all other *Ideas* or Perceptions, which suggest Magnitude or Distance, does it in the same way, that Words suggest the Notions to which they are annexed. Now, it is known, a Word pronounced with certain Circumstances, or in a certain Context with other Words, hath not always the same Import and Signification, that it hath when pronounced in some other Circumstances, or different Context of Words. This well consider'd may, perhaps, prevent some Objections that might otherwise be made, against what we have offer'd as the true Explication of the Appearance of the Horizontal Moon.

LXXIV. If we attentively consider the *Phænomenon* before us, we shall find the not discerning between the Mediate, and Immediate Objects of Sight, to be the chief Cause of the Difficulty that occurs in the Explication of it. The Magnitude of the Visible Moon, or that which is the proper and immediate *Object* of Vision, is no greater when the Moon is in the *Horizon*, than when it is in the *Meridian*. How comes it, therefore, to seem greater in one Situation than the other? What is it can put this Cheat on the Understanding? It has no other Perception of the Moon, than what it gets by Sight: And that which is seen is of the same Extent, I say, the Visible Appearance hath the very same, or, rather, a lesser Magnitude when the Moon is view'd in the *Horizontal*, than when in the *Meridional* Position: And yet it is Esteemed greater in the former, than in the latter. Herein consists the Difficulty; which doth Vanish, and admit of a most easy Solution, if we consider that, as the Visible Moon is not greater in the *Horizon*, than in the *Meridian*, so neither is it thought to be so. It hath been already shewn, that in any act of *Vision*, the Visible *Object* absolutely, or in it self, is little taken notice of, the Mind still carrying its View from that to some *Tangible Ideas*, which have been observ'd to be Connected with it, and by that means, come to be suggested by it. So that when a thing is said to appear Great, or Small, or whatever Estimate be made of the Magnitude of any Thing; this is meant, not of the Visible, but, of the *Tangible Object*. This duly consider'd, it will be no hard matter to reconcile, the seeming Contradiction there is, that the Moon shou'd appear of a different Bigness, the visible Magnitude thereof remaining still the same. For by *Sect. LVI.* the very same visible Extension, with a different Faintness, shall suggest a different *Tangible* Extension. When, therefore, the Horizontal Moon is said to appear greater than the Meridional Moon; this must be understood, not of a greater *Visible* Extension, but of a greater *Tangible* Extension; which, by reason of the more than ordinary *Faintness* of the Visible Appearance, is suggested to the Mind along with it.

LXXV. Many Attempts have been made by Learned Men, to account for this Appearance. *Gassendus, Descartes, Hobbs*, and several others, have employ'd their Thoughts on that Subject: But how fruitless and unsatisfactory their Endeavours have been, is sufficiently shewn by Mr. *Molyneux, vid. Philos. Trans. Numb. 187, p. 314.* where you may see their several Opinions at large set forth and confuted, not without some Surprize at the gross Blunders, that Ingenious Men have been forced into, by endeavouring to reconcile this Appearance with the ordinary Principles of *Optics*. Since the Writing of which Discourse, there hath been Publish'd in the Transactions, *Numb. 187, p. 323.* another Paper relating to the same Affair, by the Celebrated Dr. *Wallis*, wherein he pretends to account for that *Phænomenon*; which, tho' it seems not to contain any thing new, or different from what had been said before by others, I shall nevertheless consider in this place.

LXXVI. His Opinion in short is this. We judge not of the Magnitude of an *Object* by the Optic Angle alone, but by the Optic Angle in Conjunction with the Distance. Hence,

tho' the Angle remain the same, or even becomes less; yet if withal the Distance seem to have been increas'd, the *Object* shall appear greater. Now, one way whereby we estimate the Distance of any Thing, is by the Number and Extent of the intermediate Objects: When therefore the Moon is seen in the *Horizon*, the Variety of Fields, Houses, &c. together with the large Prospect of the wide-extended Land, or Sea, that lies between the Eye and the utmost Limb of the *Horizon*, suggest unto the Mind the *Idea* of greater Distance, and consequently magnify the Appearance. And this, according to Dr. *Wallis*, is the true Account of the extraordinary Largeness attributed by the Mind to the Horizontal Moon, at a time when the Angle subtended by its *Diameter*, is not one jot greater than it us'd to be.

LXXVII. With reference to this Opinion, not to repeat what has been already said concerning *Distance*, I shall only observe, *First*, That if the Prospect of interjacent Objects be that which suggests the *Idea* of farther Distance, and this *Idea* of farther Distance be the Cause, that brings into the Mind the *Idea* of greater Magnitude; it should hence follow, that if one look'd at the Horizontal Moon from behind a Wall, it would appear no bigger than ordinary. For in that Case, the Wall interposing, cuts off all that Prospect of Sea and Land, &c. which might otherwise increase the apparent Distance, and thereby the apparent Magnitude of the Moon. Nor will it suffice to say, the Memory doth even then suggest all that Extent of Land, &c. which lies within the *Horizon*; which Suggestion occasions a sudden Judgment of Sense, that the Moon is farther off, and larger than usual. For ask any Man, who from such a Station beholding the Horizontal Moon, shall think her greater than usual, whether he have at that time in his Mind any *Idea* of the intermediate Objects, or long Tract of Land that lies between his Eye and the extream Edge of the *Horizon*? And whether it be that *Idea* which is the Cause of his making the aforementioned Judgment? He will, without doubt, reply in the Negative, and declare the Horizontal Moon shall appear greater than the Meridional, tho' he never thinks of all or any of those things that lie between him and it. And as for the Absurdity of any *Idea*'s introducing into the Mind another, whilst it self is not perceiv'd, this has already fallen under our Observation, and is too evident to need any farther Enlargement on it. *Secondly*, It seems impossible by this *Hypothesis*, to account for the Moon's appearing in the very same Situation, at one time greater than at another. Which, nevertheless, has been shewn to be very agreeable to the Principles we have laid down, and receives a most easie and natural Explication from them.

LXXVIII. This *Phænomenon* of the Horizontal Moon is a clear Instance of the Insufficiency of Lines and Angles, for explaining the way wherein the Mind perceives, and estimates the Magnitude of outward Objects. There is, nevertheless, a use of Computation by them, in order to determin the apparent Magnitude of things, so far as they have a Connexion with, and are Proportional to those other *Ideas*, or Perceptions which are the true and immediate Occasions that suggest to the Mind the apparent Magnitude of Things. But this in general may, I think, be observ'd concerning Mathematical Computation in *Optics*: That it can hardly be very Precise and Exact, since the Judgments we make of the Magnitude of External Things, do often depend on several Circumstances, which are not Proportional to, or capable of being defin'd by *Lines* and *Angles*.

LXXIX. From what has been said we may safely deduce this Consequence, *viz.* That a Man born Blind, and made to See, wou'd, at first opening of his Eyes, make a very different

Judgment of the Magnitude of *Objects* intromitted by them, from what others do. He wou'd not consider the *Ideas* of Sight with reference to, or as having any connexion with the *Ideas* of Touch. His View of them being intirely terminated within themselves, he can no otherwise judge them *Great* or *Small*, than as they contain a greater or lesser Number of Visible Points. Now, it being certain, that any Visible Point can cover or exclude from View, only one other Visible Point, it follows, that whatever *Object* intercepts the View of another, hath an equal Number of Visible Points with it; and consequently they shall both, by him, be thought to have the same Magnitude. Hence, it's evident, one in those Circumstances would judge his Thumb, with which he might hide a Tower, or hinder its being seen, equal to that Tower, or his Hand, the Interposition whereof might conceal the Firmament from his View, equal to the Firmament. How great an Inequality soever there may, in our Apprehensions, seem to be betwixt those two things: because of the customary and close Connexion, that has grown up in our Minds between the *Objects* of *Sight* and *Touch*, whereby the very different and distinct *Ideas* of those two Senses, are so blended and confounded together, as to be mistaken for one and the same thing; out of which Prejudice, we cannot totally extricate our selves, without some Labour and Striving of Thought.

LXXX. For the better clearing up the Nature of *Vision*, and setting the manner wherein we perceive Magnitudes in a due Light, I shall proceed to make some Observations concerning Matters relating thereto, whereof the want of Reflexion, and duly separating between *Tangible* and *Visible Ideas*, is apt to create in us mistaken and confused Notions. And, *First*, I shall observe that the *Minimum Visibile* is exactly equal in all Beings whatsoever, that are endow'd with the Visive Faculty. No exquisite Formation of the Eye, no peculiar Sharpness of Sight, can make it less in one Creature, than in another. For it not being distinguishable into Parts, nor in any wise consisting of them, it must necessarily be the same to all. For suppose it otherwise, and that the *Minimum Visibile* of a Mite, for Instance, be less than the *Minimum Visibile* of a Man; the latter, therefore, may by Detraction of some part be made equal to the former: It doth, therefore, consist of Parts: Which is inconsistent with the Notion of a *Minimum Visibile*, or Point.

LXXXI. It will, perhaps, be objected, that the *Minimum Visibile* of a Man doth really, and in it self, contain Parts whereby it surpasses that of a Mite, tho' they are not perceivable by the Man. To which I answer, the *Minimum Visibile* having (in like manner as all other the Proper and Immediate *Objects* of Sight) been shewn not to have any Existence without the Mind of him who sees it, it follows, there cannot be any part of it that is not actually perceiv'd, and therefore Visible. Now, for any *Object* to contain several distinct, visible Parts, and at the same time to be a *Minimum Visibile*, is a manifest Contradiction.

LXXXII. Of these Visible Points we see at all times an equal Number. It is every whit as great when our View is contracted, and bounded by near *Objects*, as when it is extended to larger and remoter ones. For it being impossible, that one *Minimum Visibile* should obscure, or keep out of Sight, more than one other; it's a plain Consequence, that when my View is on all sides bounded by the Walls of my Study, I see just as many visible Points, as I cou'd, in case that by the Removal of the Study-Walls, and all other Obstructions, I had a full Prospect of the circumjacent Fields, Mountains, Sea and open Firmament. For, so long as I am shut up within the Walls, by their Interposition every Point of the External *Object* is cover'd from

my View. But each Point that is seen, being able to cover or exclude from Sight, one only other corresponding Point: It follows, that whilst my Sight is confin'd to those narrow Walls, I see as many Points, or *Minima Visibilia*, as I should, were those Walls away, by looking on all the External *Objects*, whose Prospect is intercepted by them. Whenever, therefore, we are said to have a greater Prospect at one time than another; this must be understood with relation, not to the proper and immediate, but the secondary and mediate *Objects* of Vision, which, as hath been shewn, do properly belong to the *Touch*.

LXXXIII. The *Visive Faculty* consider'd, with reference to it's immediate *Objects*, may be found to Labour of two Defects. *First*, In respect of the Extent or Number of visible Points that are at once perceivable by it, which is narrow and limited to a certain Degree. It can take in at one View but a certain, determinate Number of *Minima Visibilia*, beyond which it cannot extend it's Prospect. *Secondly*, Our Sight is defective in that its View is not only narrow, but also, for the most part, confus'd. Of those things that we take in at one Prospect, we can see but a few at once clearly and unconfusedly. And the more we fix our Sight on any one *Object*, by so much the Darker and more Indistinct shall the rest appear.

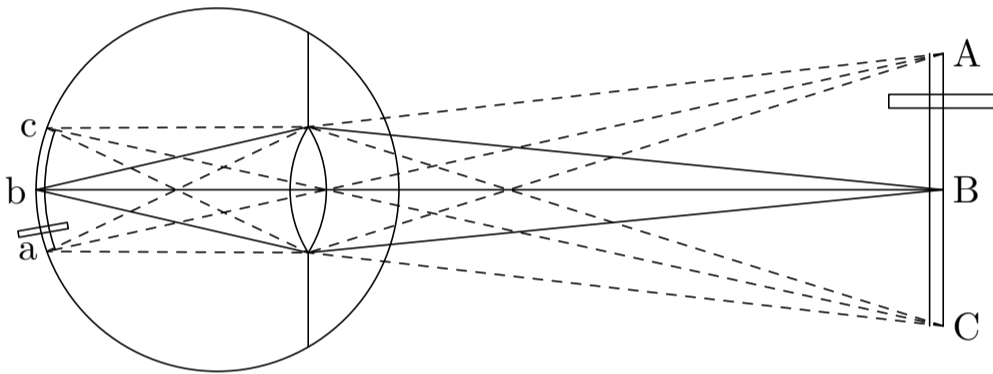
LXXXIV. Corresponding to these two Defects of Sight, we may imagine as many Perfections, *viz.* 1<sup>st</sup>. That of comprehending in one View, a greater number of Visible Points. 2<sup>dly</sup>, Of being able to View them all equally, and at once, with the utmost Clearness and Distinction. That these Perfections are not actually in some Intelligences, of a different Order and Capacity from ours, it is impossible for us to know.

LXXXV. In neither of these two Ways, do *Microscopes* contribute to the improvement of Sight. For, when we look thro' a *Microscope*, we neither see more Visible Points, nor are the Collateral Points more Distinct, than when we look with the naked Eye, at *Objects* placed in a due Distance. A *Microscope* brings us, as it were, into a new World: It presents us with a new Scene of Visible *Objects*, quite different from what we behold with the naked Eye. But herein consists the most remarkable Difference, *viz.* That whereas the *Objects* perceived by the Eye alone have a certain Connexion with *Tangible Objects*, whereby we are taught to Foresee what will ensue, upon the Approach or Application of distant *Objects* to the Parts of our own Body, which much conduceth to it's Preservation; there is not the like Connexion between things *Tangible* and those Visible *Objects*, that are perceiv'd by help of a fine *Microscope*.

LXXXVI. Hence it's evident, that were our Eyes turned into the Nature of *Microscopes*, we shou'd not be much benefited by the Change. We shou'd be depriv'd of the foremention'd Advantage we at present receive by the *Visive Faculty*; and have left us only the empty Amusement of *Seeing*, without any other benefit arising from it. But in that Case, it will perhaps be said, our Sight wou'd be endued with a far greater Sharpness and Penetration than it now hath. But I wou'd fain know wherein consists that *Sharpness*, which is esteem'd so great an Excellency of Sight. It is certain from what we have already shewn, that the *Minimum Visibile* is never Greater, or Lesser, but in all Cases constantly the same. And in the Case of Microscopical Eyes, I see only this difference, *viz.* that upon the Ceasing of a certain observable Connexion, betwixt the divers Perceptions of *Sight* and *Touch*, which before enabled us to regulate our Actions by the Eye: It wou'd now be render'd utterly unserviceable to that Purpose. Which whether it be a desirable Perfection, or no, I leave it to any one to determin.

LXXXVII. Upon the whole, my Opinion is, That if we consider the Use and End of *Sight*, together with the present State and Circumstances of our Being, we shall not find any great Cause, to complain of any Defect or Imperfection in it, or easily conceive how it cou'd be mended. With such admirable Wisdom is that Faculty contriv'd, both for the Pleasure and Conveniency of Life.

LXXXVIII. Having finish'd what I intended to say, concerning the *Distance* and *Magnitude* of *Objects*, I come now to treat of the Manner, wherein the Mind perceives by *Sight* their *Situation*. Among the Discoveries of the last Age, it is reputed none of the least, that the manner of *Vision* has been more clearly Explain'd, than ever it had been before. There is, at this Day, no one Ignorant, that the Pictures of External *Objects* are Painted on the *Retina*, or Fund of the Eye. That we can see no thing which is not so Painted. And that, according as the Picture is more Distinct or Confused, so also is the Perception we have of the Object. But then in this Explication of *Vision*, there occurs one mighty Difficulty. The *Objects* are Painted in an inverted Order on the Bottom of the Eye: The *upper* part of any *Object* being Painted on the *lower* part of the *Eye*, and the *lower* part of the *Object*, on the *upper* part of the *Eye*. And so also as to *Right* and *Left*. Since therefore the Pictures are thus inverted, it is demanded how it comes to pass, that we see the *Objects* erect and in their natural Posture?



LXXXIX. In answer to this Difficulty, we are told, that the Mind perceiving an impulse of a Ray of Light, on the upper part of the Eye, considers this Ray as coming in a direct Line, from the lower part of the *Object*; and in like manner tracing the Ray that strikes on the lower part of the Eye, it is directed to the upper part of the *Object*. Thus in the adjacent Figure, *C* the lower point of the object *ABC* is projected on *c* the upper part of the Eye. So likewise, the highest Point *A* is projected on *a* the lowest part of the Eye; which makes the Representation *c b a* inverted. But the Mind considering the Stroke that is made on *c* as coming in the straight Line *C c* from the lower End of the *Object*; and the Stroke or Impulse on *a*, as coming in the Line *A a* from the upper End of the *Object*, is directed to make a right Judgement of the Situation of the *Object ABC*, notwithstanding the Picture of it be inverted. Moreover, this is illustrated by conceiving a Blind Man, who holding in his Hands two Sticks that cross each other, doth with them touch the extremities of an *Object*, placed in a perpendicular Situation. It is certain, this Man will judge that to be the upper part of the *Object*, which he touches with the Stick held in the undermost Hand, and that to be the

lower part of the *Object*, which he touches with the stick in his uppermost Hand. This is the common Explication of the erect Appearance of *Objects*, which is generally receiv'd and acquiesced in, being (as Mr. *Molyneux* tells us, *Dioptr. par. 2. c. 7. p. 289.*) *allowed by all Men as Satisfactory.*

XC. But how reasonable and satisfactory soever, this account may be thought by others, to me certainly it does not seem, in any degree, True. Did I perceive those Impulses, Decussations, and Directions of the Rays of Light, in like manner as hath been set forth, then, indeed, it wou'd not at first view be altogether void of Probability. And there might be some Pretence for the Comparison of the Blind-Man and his cross Sticks. But the Case is far otherwise. I know very well that I perceive no such thing. And of Consequence, I cannot thereby make an Estimate of the Situation of *Objects*. Moreover I appeal to any one's Experience, whether he be conscious to himself, that he thinks on the Intersection made by the Radius Pencils, or pursue the Impulses they give in right Lines, whenever he perceives by Sight the Position of any *Object*? To me it seems evident, that Crossing and Tracing of the Rays, &c. is never thought on by Children, Idiots, or in Truth by any other, save only those who have applyed themselves to the Study of *Optics*. And for the Mind to judge of the Situation of *Objects*, by those things, without perceiving them, or to perceive them without knowing it, take which you please, 'tis Perfectly beyond my Comprehension. Add to this, that the explaining the manner of *Vision* by the Example of cross Sticks, and Hunting for the *Object* along the Axes of the Radius Pencils, doth suppose the proper *Objects* of Sight to be perceived at a Distance from us, contrary to what hath been Demonstrated. We may therefore, venture to pronounce this Opinion concerning the way wherein the Mind perceives the Erect Appearance of *Objects*, to be of a Piece with those other Tenents of Writers in *Optics*, which in the foregoing Parts of this Treatise, we have had occasion to Examine and Refute.

XCI. It remains, therefore, that we look for some other Explication of this Difficulty. And I believe it not impossible to find one, provided we Examine it to the Bottom, and carefully distinguish between the *Ideas* of *Sight* and *Touch*; which cannot be too oft inculcated in treating of *Vision*. But more especially throughout the consideration of this Affair, we ought to carry that Distinction in our Thoughts. For that from want of a right Understanding thereof, the Difficulty of Explaining *Erect Vision* seems chiefly to arise.

XCII. But in order to Disentangle our Minds, from whatever Prejudices we may entertain with relation to the Subject in hand: Nothing seems more apposite, than the taking into our Thoughts the Case of one Born Blind, and afterwards, when grown up, made to see. And tho', perhaps, it may not be a Task altogether easy, and familiar to us, to divest our selves intirely of the Experiences receiv'd from Sight, so as to be able to put our Thoughts exactly in the Posture of such a one's; we must, nevertheless, as far as possible, endeavour to frame true Conceptions, of what might reasonably be supposed to pass in his Mind.

XCIII. It is certain, that a Man actually Blind, and who had continued so from his Birth, wou'd by the Sense of Feeling attain to have *Ideas* of *Upper* and *Lower*. By the Motion of his Hand he might discern the Situation of any Tangible *Object* placed within his Reach. That part on which he felt himself supported, or towards which he perceiv'd his

Body to gravitate, he wou'd term *Lower*, and the contrary to this *Upper*. And accordingly denominate whatsoever *Objects* he touch'd.

XCIV. But then, whatever Judgments he makes concerning the Situation of *Objects*, are confin'd to those only that are perceivable by *Touch*. All those things that are intangible, and of a spiritual Nature, his Thoughts and Desires, his Passions, and in general all the Modifications of his Soul, to these he wou'd never apply the Terms *Upper* and *Lower*, except only in a Metaphorical Sense. He may, perhaps, by way of Allusion, speak of High or Low Thoughts. But those Terms in their proper Signification, wou'd never be applyed to any thing, that was not conceiv'd to exist without the Mind. For a Man Born Blind, and remaining in the same State, cou'd mean nothing else by the Words *Higher* and *Lower*, than a greater or lesser Distance from the Earth: Which Distance he wou'd measure by the Motion or Application of his Hand, or some other Part of his Body. It is, therefore, evident, that all those things which, in respect of each other, wou'd by him be thought Higher or Lower, must be such as were conceiv'd to exist without his Mind, in the ambient Space.

XCV. Whence it plainly follows, that such a one, if we suppose him made to See, wou'd not at first Sight think, that any thing he saw was High or Low, Erect or Inverted; for it hath been already Demonstrated in *Sect XLI*, that he wou'd not think the Things he perceived by Sight to be at any Distance from him, or without his Mind. The *Objects* to which he had hitherto been used to apply the Terms *Up* and *Down*, *High* and *Low*, were such only as affected, or were some way perceiv'd by his *Touch*. But the proper *Objects* of *Vision* make a new Set of *Ideas*, perfectly distinct and different from the former, and which can in no sort make themselves perceiv'd by *Touch*. There is, therefore, nothing at all that cou'd induce him to think those Terms applicable to them. Nor wou'd he ever think it, till such time as he had observ'd their Connexion with Tangible *Objects*, and the same Prejudice begin to insinuate it self into his Understanding, which from their Infancy had grown up in the Understandings of other Men.

XCVI. To set this Matter in a clearer Light, I shall make use of an Example. Suppose the above-mentioned Blind Person do, by his *Touch*, perceive a Man to stand Erect. Let us enquire into the manner of this. By the application of his Hand to the several Parts of a Human Body, he had perceiv'd different Tangible *Ideas*, which being collected into sundry complex ones have distinct Names annexed to them. Thus one Combination of a certain Tangible Figure, Bulk, and Consistency of Parts is called the *Head*, another the *Hand*, a Third the *Foot*, and so of the rest. All which Complex *Ideas* cou'd, in his Understanding, be made up only of *Ideas* perceivable by *Touch*. He had also by his *Touch* obtain'd an *Idea* of Earth or Ground, towards which he perceives the Parts of his Body to have a natural Tendency. Now, by *Erect* nothing more being meant, than that perpendicular Position of a Man, wherein his Feet are nearest to the Earth: If the Blind Person by moving his Hand, over the Parts of the Man who stands before him, do perceive the Tangible *Ideas* that compose the Head, to be farthest from, and those that compose the Feet to be nearest to, that other Combination of Tangible *Ideas* which he calls *Earth*: He will denominate that Man *Erect*. But if we suppose him on a sudden to receive his Sight, and that he behold a Man standing before him: It's evident, in that Case, he wou'd neither judge the Man he sees, to be *Erect* nor *Inverted*; for he never having known those Terms applied to any other, save Tangible



Things, or which existed in the Space without him, and what he sees neither being Tangible, nor perceived as existing without, he cou'd not know that in propriety of Language, they were applicable to it.

XCVII. Afterwards, when upon turning his Head or Eyes, up and down, to the right and left, he shall observe the Visible Objects to change, and shall also attain to know, that they are call'd by the same Names, and Connected with the Objects perceiv'd by Touch; then, indeed, he will come to speak of them, and their Situation, in the same Terms that he has been us'd to apply to Tangible Things. And those that he perceives by turning up his Eyes, he will call *Upper*, and those that by turning down his Eyes, he will call *Lower*.

XCVIII. And this seems to me the true Reason, why he shou'd think those Objects uppermost that are Painted on the lower part of his Eye. For, by turning the Eye *up* they shall be distinctly seen; as likewise they that are Painted on the highest part of the Eye shall be distinctly seen, by turning the Eye *down*, and are for that Reason esteemed lowest. For we have shewn that to the immediate Objects of Sight, consider'd in themselves, he'd not attribute the Terms *High* and *Low*. It must therefore be on account of some Circumstances, which are observ'd to attend them. And these, 'tis plain, are the Actions of turning the Eye up and down, which suggest a very obvious Reason, why the Mind shou'd denominate the Objects of Sight accordingly *High* or *Low*. And without this Motion of the Eye, this turning it up and down in order to discern different Objects, doubtless *Erect*, *Inverse*, and other the like Terms relating to the Position of Tangible Objects, wou'd never have been transferr'd, or in any degree apprehended to belong to the *Ideas* of Sight: The meer act of Seeing including nothing in it to that Purpose, whereas the different Situations of the Eye, naturally direct the Mind to make a suitable Judgement, of the Situation of *Objects* intromitted by it.

XCIX. Farther, when he has by Experience learn'd the Connexion there is between the several *Ideas* of Sight and Touch, he will be able, by the Perception he has of the Situation of Visible Things in respect of one another, to make a sudden and true Estimate, of the Situation of Outward, Tangible things corresponding to them. And thus it is, he shall perceive by Sight the Situation of External *Objects*, which do not properly fall under that Sense.

C. I know we are very prone to think, that if just made to see, we shou'd judge of the Situation of Visible Things as we do now. But, we are also as prone to think, that at first Sight, we shou'd in the same way apprehend the Distance and Magnitude of Objects, as we do now. Which hath been shewn to be a false and groundless Perswasion. And for the like Reasons, the same Censure may be past on the positive Assurance, that most Men, before they have thought sufficiently of the Matter, might have of their being able to determine by the Eye, at first view, whether *Objects* were *Erect* or *Inverse*.

CI. It will, perhaps, be objected to our Opinion, that a Man, for instance, being thought Erect, when his Feet are next the Earth, and inverted, when his Head is next the Earth, it doth hence follow, that by the meer act of Vision, without any Experience or altering the Situation of the Eye, we shou'd have determin'd whether he were Erect or Inverted. For both the Earth it self, and the Limbs of the Man who stands thereon, being equally perceiv'd by Sight: One cannot chuse seeing, what part of the Man is nearest the Earth, and what part farthest from it, *i. e.* whether he be Erect or Inverted.

CII. To which I answer, the *Ideas* which constitute the Tangible Earth and Man, are intirely different from those which constitute the Visible Earth and Man. Nor was it possible, by virtue of the Visive Faculty alone, without super-adding any Experience of *Touch*, or altering the Position of the Eye, ever to have known, or so much as suspected, there had been any Relation or Connexion between them. Hence, a Man at first view wou'd not denominate any thing he saw *Earth*, or *Head*, or *Foot*. And consequently, he cou'd not tell by the meer act of *Vision*, whether the Head or Feet were nearest the Earth. Nor, indeed, wou'd he have thereby any thought of *Earth* or *Man*, *Erect* or *Inverse*, at all. Which will be made yet more evident, if we nicely observe, and make a particular Comparison between the *Ideas* of both Senses.

CIII. That which I see is only variety of Light and Colours. That which I feel, is Hard or Soft, Hot or Cold, Rough or Smooth. What Similitude, what Connexion have those *Ideas* with these? Or how is it possible, that any one shou'd see reason, to give one and the same Name, to combinations of *Ideas* so very different, before ever he had experienced their Coexistence? We do not find there is any necessary Connexion, betwixt this or that Tangible Quality, and any Colour whatsoever. And we may sometimes perceive Colours, where there is nothing to be felt. All which doth make it manifest, that no Man at first receiving of his Sight, wou'd know there was any Agreement between this or that particular *Object* of his Sight, and any *Object* of Touch he had been already acquainted with. The Colours therefore of the Head, wou'd to him no more suggest the *Idea* of *Head*, than they wou'd the *Idea* of *Feet*.

CIV. Farther, we have at large shewn (*vid. Sect. LXIII. and LXIV.*) there is no discoverable, necessary Connexion, between any given Visible Magnitude, and any one particular Tangible Magnitude. But that it is intirely the result of Custom and Experience, and depends on foreign and accidental Circumstances, that we can by the Perception of Visible Extension inform our selves, what may be the Extension of any *Tangible Object* connected therewith. Hence, 'tis certain that neither the Visible Magnitude of Head or Foot, wou'd bring along with them into the Mind, at first opening of the Eyes, the respective Tangible Magnitudes of those Parts.

CV. By the foregoing *Section* 'tis plain, the Visible Figure of any Part of the Body, hath no necessary Connexion with the Tangible Figure thereof, so as at first Sight to suggest it to the Mind. For *Figure* is the Termination of Magnitude. Whence it follows, that no Visible Magnitude having, in it's own Nature, an aptness to suggest any one particular Tangible Magnitude, so neither can any Visible Figure, be inseparably Connected with its corresponding Tangible Figure: So as of it self, and in a way *prior* to Experience it might suggest it to the Understanding. This will be farther evident, if we consider that what seems Smooth and Round to the Touch, may to Sight, if view'd thro' a *Microscope*, seem quite otherwise.

CVI. From all which laid together, and duly consider'd, we may clearly deduce this Inference, *viz.* In the first act of Vision, no *Idea* entering by the Eye, wou'd have a perceivable Connexion with the *Ideas* to which the Names *Earth*, *Man*, *Head*, *Foot*, &c. were annexed, in the Understanding of a Person Blind from his Birth: So as in any sort to introduce them into

his Mind, or make themselves be called by the same Names, and reputed the same things with them, as afterwards they come to be.

CVII. There doth, nevertheless, remain one Difficulty, which to some perhaps, may seem to press hard on our Opinion, and deserve not to be pass'd over. For tho' it be granted, that neither the Colour, Size, nor Figure of the Visible Feet, have any necessary Connexion with the *Ideas* that compose the Tangible Feet, so as to bring them at first sight, into my Mind, or make me in danger of confounding them, before I had been us'd to, and for some time experienced their Connexion: Yet thus much seems undeniable. Namely, that the Number of the Visible Feet, being the same with that of the Tangible Feet: I may from hence, without any Experience of Sight, reasonably conclude that they represent, or are connected with the Feet rather than the Head. I say, it seems the *Idea* of *Two* Visible Feet will sooner suggest to the Mind, the *Idea* of *Two* Tangible Feet than of *one* Head. So that the Blind Man upon first reception of the Visive Faculty might know, which were the Feet or Two, and which, the Head or One.

CVIII. In order to get clear of this seeming Difficulty, we need only observe, that Diversity of Visible Objects does not necessarily infer, Diversity of Tangible Objects, corresponding to them. A Picture Painted with great variety of Colours, affects the Touch in one uniform manner. It is therefore evident, that I do not by any necessary Consecution, independent of Experience, judge of the number of things Tangible, from the number of things Visible. I shou'd not therefore at first opening my Eyes conclude, that because I see Two, I shall feel Two. How therefore can I, before Experience teaches me, know that the Visible Legs, because *Two*, are connected with the Tangible Legs: Or the Visible Head, because *One*, connected with the Tangible Head? The Truth on't is, the things I see are so very different, and heterogeneous from the things I feel: That the Perception of the one, wou'd never have suggested the other to my Thoughts, or enabled me to pass the least Judgment thereon, until I had Experienced their Connexion.

CIX. But for a fuller Illustration of this Matter, it ought to be consider'd, that *Number* (however some may reckon it amongst the Primary Qualities) is nothing fix'd, and settled, really existing in things themselves. It is intirely the Creature of the Mind, considering, either a Simple *Idea* by it self, or any Combination of Simple *Ideas* to which it gives one Name, and so makes it pass for an Unite. According as the Mind variously Combines it's *Ideas*, the Unite varies. And as the Unite, so the Number, which is only a Collection of Unites, doth also vary. We call a Window *one*, a Chimney *one*; and yet a House in which there are many Windows, and many Chimneys, has an equal right to be called *one*. And many Houses go to the making of *one* City. In these and the like Instances, it's evident the *Unite* constantly relates to the particular Draughts the Mind makes of it's *Ideas*, to which it affixes Names, and wherein it includes more or less, as best suits it's own Ends and Purposes. Whatever therefore the Mind considers as one, that is an Unite. Every Combination of *Ideas* is consider'd as one thing by the Mind, and in token thereof, is mark'd by one Name. Now, this Naming and Combining together of *Ideas* is perfectly Arbitrary, and done by the Mind in such sort, as Experience shews it to be most convenient. Without which, our *Ideas* had never been collected into such sundry, distinct Combinations, as they now are.

CX. Hence it follows, that a Man Born Blind, and afterwards, when grown up, made to

see, wou'd not in the first act of Vision, parcel out the *Ideas* of Sight, into the same distinct Collections that others do, who have experienced which do regularly coexist and are proper to be bundled up together under one Name. He wou'd not, for Example, make into one complex *Idea*, and thereby esteem an unite all those particular *Ideas* which constitute the Visible Head, or Foot. For there can be no Reason assign'd why he shou'd do so, barely upon his seeing a Man stand upright before him. There croud into his Mind, the *Ideas* which compose the Visible Man, in company with all the other *Ideas* of Sight perceiv'd at the same time. But all these *Ideas* offer'd at once to his View, he'd not distribute into sundry, distinct Combinations: till such time, as by observing the Motion of the Parts of the Man, and other Experiences he comes to know, which are to be separated, and which to be collected together.

CXI. From what hath been premised, 'tis plain the Objects of Sight and Touch make, if I may so say, two Sets of *Ideas*, which are widely different from each other. To Objects of either Kind, we indifferently attribute the Terms *High* and *Low*, *Right* and *Left*, and such like, denoting the Position or Situation of things. But then we must well observe, that the Position of any *Object* is determin'd, with respect only to *Objects* of the same Sense. We say any *Object* of Touch is *High* or *Low*, according as it is more or less distant from the Tangible Earth. And in like manner, we denominate any *Object* of Sight *High* or *Low*, in proportion as it is more or less Distant, from the Visible Earth. But to define the Situation of Visible Things, with relation to the Distance they bear from any Tangible Thing, or *vice versa*: This were absurd and perfectly unintelligible. For all Visible Things are equally in the Mind, and take up no part of the External Space: And, consequently, are Equidistant from any Tangible Thing which exists without the Mind.

CXII. Or rather, to speak truly, the proper *Objects* of Sight are at no Distance, neither near nor far, from any Tangible Thing. For if we inquire narrowly into the Matter, we shall find, that those things only are compar'd together in respect of Distance, which exist after the same manner, or appertain unto the same Sense. For by the *Distance* between any Two Points, nothing more is meant than the Number of intermediate Points. If the given Points are Visible, the Distance between them is mark'd out, by the Number of the interjacent Visible Points: If they are Tangible, the Distance between them is a Line consisting of Tangible Points. But if they are one Tangible, and the other Visible, the Distance between them doth neither consist of Points perceivable by Sight, nor by Touch, *i. e.* it is utterly inconceivable. This, perhaps, will not find an easy Admission into all Men's Understandings: However, I shou'd gladly be informed whether it be not True, by any one who will be at the pains to Reflect a little, and apply it home to his Thoughts.

CXIII. The not observing what has been deliver'd in the two last *Sections*, seems to have occasion'd no small part of the Difficulty that occurs in the Business of *Erect Appearances*. The Head, which is Painted nearest the Earth, seems to be farthest from it; and on the other Hand, the Feet, which are Painted farthest from the Earth, are thought nearest to it. Herein lies the Difficulty, which vanishes if we express the thing more clearly, and free from Ambiguity, thus. How comes it that to the Eye, the Visible Head which is nearest the Tangible Earth, seems farthest from the Earth, and the Visible Feet, which are farthest from the Tangible Earth, seem nearest the Earth? The Question being thus propos'd, who sees not, the Difficulty is founded on a Supposition, that the Eye or Visive Faculty, or rather the Soul

by means thereof, shou'd judge of the Situation of Visible Objects, with Reference to their Distance from the Tangible Earth? Whereas it's evident, the Tangible Earth is not perceiv'd by Sight: And it hath been shewn in the two last preceding *Sections*, that the Location of Visible Objects is determin'd only, by the Distance they bear from one another; and that it is Nonsense to talk of Distance, far or near, between a Visible and Tangible Thing.

CXIV. If we confine our Thoughts to the proper Objects of Sight, the whole is plain and easy. The Head is Painted farthest from, and the Feet nearest to the Visible Earth: And so they appear to be. What is there strange or unaccountable in this? Let us suppose the Pictures in the Fund of the Eye, to be the immediate Objects of Sight. The Consequence is, that things shou'd appear in the same Posture they are Painted in. And is it not so? The Head which is seen, seems farthest from the Earth which is seen; and the Feet, which are seen, seem nearest to the Earth which is seen. And just so they are Painted.

CXV. But, say you, the Picture of the Man is *inverted*, and yet the Appearance is *Erect*. I ask what mean you by the Picture of the Man, or, which is the same thing, the Visible Man's being inverted? You tell me 'tis inverted, because the Heels are uppermost, and the Head undermost? Explain me this. You say, that by the Head's being undermost, you mean that it is nearest to the Earth; and by the Heels being uppermost, that they are farthest from the Earth. I ask again, what Earth you mean? You cannot mean the Earth that is Painted on the Eye, or the Visible Earth. For the Picture of the Head is farthest from the Picture of the Earth; and the Picture of the Feet nearest to the Picture of the Earth; and accordingly, the Visible Head is farthest from the Visible Earth, and the Visible Feet, nearest to it. It remains, therefore, that you mean the Tangible Earth: And so determine the Situation of *Visible* Things, with respect to *Tangible* Things; contrary to what hath been demonstrated in *Sect.* CXI. and CXII. The two distinct Provinces of *Sight* and *Touch* shou'd be consider'd apart, and as tho' their *Objects* had no Intercourse, no manner of Relation to one another, in point of Distance or Position.

CXVI. Farther, What greatly contributes to make us mistake in this Matter is, that when we think of the Pictures in the Fund of the Eye, we imagine our selves looking on the Fund of another's Eye, or another looking on the Fund of our own Eye, and beholding the Pictures Painted thereon. Suppose two Eyes *A* and *B*: *A* from some distance looking on the Pictures in *B* sees them inverted, and for that reason concludes they are inverted in *B*. But this is wrong. There are projected in *little* on the Bottom of *A*, the Images of the Pictures of, suppose, *Man, Earth, &c.* which are Painted on *B*. And besides these, the Eye *B* it self, and the *Objects* which environ it, together with another Earth are projected in a larger Size on *A*. Now, by the Eye *A*, these larger Images are deemed the *true Objects*, and the lesser only *Pictures* in miniature. And it is with respect to those greater Images, that it determines the Situation of the smaller Images. So that comparing the little Man with the great Earth, *A* judges him inverted, or that the Feet are farthest from, and the Head nearest to the great Earth. Whereas, if *A* compare the little Man with the little Earth, then he will appear Erect, *i. e.* his Head shall seem farthest from, and his Feet nearest to the little Earth. But we must consider that *B* does not see two Earths, as *A* does: It sees only what is represented by the little Pictures in *A*, and consequently shall judge the Man *Erect*. For in truth, the Man in *B* is not inverted, for there the Feet are next the Earth. But it is the Representation of it in *A*

which is inverted, for there, the Head of the Representation of the Picture of the Man in *B*, is next the Earth, and the Feet farthest from the Earth, meaning the Earth which is without the Representation of the Pictures in *B*. For if you take the little Images of the Pictures in *B*, and consider them by themselves, and with respect only to one another, they are all *Erect* and in their natural Posture.

CXVII. Farther, there lies a Mistake, in our imagining that the Pictures of External *Objects* are Painted on the Bottom of the Eye. It hath been shewn, there is no resemblance between the *Ideas* of Sight, and things Tangible. It hath likewise been demonstrated, that the proper *Objects* of Sight do not exist without the Mind. Whence it clearly follows, that the Pictures Painted on the Bottom of the Eye, are not the Pictures of External *Objects*. Let any one consult his own Thoughts, and then tell me, what Affinity, what Likeness there is, between that certain Variety and Disposition of Colours, which constitute the Visible Man, or Picture of a Man, and that other Combination of far different *Ideas*, sensible by Touch, which compose the Tangible Man. But if this be the Case, how come they to be accounted *Pictures* or *Images*, since that supposes them to copy or represent some Originals or other?

CXVIII. To which I answer: In the foremention'd Instance, the *Eye A* takes the little Images, included within the Representation of the other Eye *B*, to be Pictures or Copies, whereof the *Archetypes* are not things existing without but, the larger Pictures projected on it's own Fund: And which by *A* are not thought Pictures, but the Originals or true Things themselves. Tho' if we suppose a third Eye *C*, from a due distance to behold the Fund of *A*: Then, indeed, the things projected thereon shall, to *C*, seem Pictures or Images, in the same Sense that those projected on *B* do to *A*.

CXIX. Rightly to conceive the Business in hand, we must carefully distinguish between the *Ideas* of *Sight* and *Touch*, between the Visible and Tangible Eye, for certainly on the Tangible Eye, nothing either is or seems to be Painted. Again, the Visible Eye, as well as all other Visible Objects, hath been shewn to exist only in the Mind, which perceiving its own *Ideas*, and comparing them together, doth call some Pictures in respect of others. What hath been said being rightly comprehended and laid together, does, I think, afford a full and genuine Explication of the Erect Appearance of Objects, which *Phænomenon*, I must confess, I do not see how it can be explain'd, by any *Theories* of *Vision* hitherto made publick.

CXX. In treating of these things, the use of Language is apt to occasion some Obscurity and Confusion, and create in us wrong *Ideas*. For Language being accomodated to the common Notions and Prejudices of Men, it is scarce possible to deliver the naked and precise Truth, without great Circumlocution, Impropriety, and (to an unwary Reader) seeming Contradictions. I do therefore, once for all, desire whoever shall think it worth his while, to understand what I have written concerning *Vision*, that he'd not stick in this or that Phrase, or manner of Expression; but candidly collect my meaning from the whole Sum and Tenor of my Discourse; and laying aside the Words, as much as possible, consider the bare Notions themselves, and then judge whether they are agreeable to Truth and his own Experience, or no.

CXXI. We have shewn the way wherein the Mind by Mediation of Visible *Ideas*, doth perceive or apprehend the *Distance*, *Magnitude* and *Situation* of Tangible Objects. I come

now to inquire more particularly, concerning the Difference betwixt the *Ideas* of *Sight* and *Touch*, which are call'd by the same Names; and see whether there be any *Idea* common to both Senses. From what we have at large set forth and demonstrated in the foregoing parts of this Treatise, 'tis plain there's no one self-same numerical Extension, perceiv'd both by Sight and Touch. But that the particular Figures and Extensions perceiv'd by Sight, however they may be called by the same Names, and reputed the same Things, with those perceiv'd by Touch, are nevertheless different, and have an Existence very distinct and Separate from them. So that the Question is not now concerning the same numerical *Ideas*, but whether there be any one and the same sort or *Species* of *Ideas* equally perceivable to both Senses? Or, in other Words, whether Extension, Figure, and Motion perceiv'd by Sight, are not specifically distinct from Extension, Figure and Motion perceived by Touch.

CXXII. But, before I come more particularly to Discuss this Matter, I find it proper to take into my Thoughts Extension in *Abstract*: For of this there is much talk, and I am apt to think, that when Men speak of *Extension* as being an *Idea* common to Two Senses, it is with a secret Supposition, that we can single out Extension from all other Tangible and Visible Qualities, and frame thereof an Abstract *Idea*, which *Idea* they will have common both to Sight and Touch. We are therefore to understand by *Extension in Abstract*, an *Idea* of Extension, *v. g.* a Line or Surface, intirely stript of all other sensible Qualities and Circumstances that might determine it to any particular Existence. It is neither Black, nor White, nor Red, nor hath it any Colour at all, or any Tangible Quality whatsoever. And consequently it is of no finite, determinate Magnitude. For, that which bounds or distinguishes one Extension from another, is some Quality or Circumstance wherein they disagree.

CXXIII. Now I do not find that I can perceive, imagine, or any wise frame in my Mind such an abstract *Idea*, as is here spoken of. A Line, or Surface which is neither Black, nor White, nor Blue, nor Yellow, *&c.* Nor Long, nor Short, nor Rough, nor Smooth, nor Square, nor Round, *&c.* is perfectly incomprehensible. This I am sure of as to my self, how far the Faculties of other Men may reach, they best can tell.

CXXIV. I know 'tis commonly said, that the *Object* of *Geometry* is Abstract Extension. To this I cannot agree, for *Geometry* contemplates Figures: Now, Figure is the Termination of Magnitude, but we have shewn that Extension in Abstract hath no finite, determinate Magnitude, whence it clearly follows that it can have no Figure, and consequently is not the *Object* of *Geometry*. I know it is a Tenent as well of the Modern as the Ancient Philosophers, that all general Truths are concerning Universal, Abstract *Ideas*, without which, we are told, there cou'd be no Science, no Demonstration of any general Proposition in *Geometry*. But it were no hard matter, did I think it necessary to my present Purpose, to shew that Propositions and Demonstrations in *Geometry* might be Universal, tho' they who make 'em never think of Abstract general *Ideas* of Triangles or Circles.

CXXV. After reiterated Efforts and pangs of Thought, in order to apprehend the general *Idea* of *v. g.* a Triangle, I have found it altogether incomprehensible. And surely if any one were able to let that *Idea* into my Mind, it must be the deservedly admir'd Author of the *Essay concerning Human Understanding*: He, who has so far distinguish'd himself from the generality of Writers, by the Clearness and Significancy of what he Says. Let us therefore

see how that great Man describes the general, or, which is the same thing, the Abstract *Idea* of a Triangle. 'It must be,' (*says he*) 'neither Oblique, nor Rectangle, neither Equilateral, Equicrural, nor Scalenon; but *all and none* of these at once. In effect it is somewhat imperfect that cannot exist; an *Idea*, wherein some Parts of several different and inconsistent *Ideas* are put together.' *Essay on Hum. Understand. b. iv. c. 7. s. 9.* This is the *Idea*, which he thinks needful, for the enlargement of Knowledge, which is the Subject of Mathematical Demonstration, and without which we cou'd never come to know any general Proposition concerning Triangles. Sure I am, if this be the Case, 'tis impossible for me to attain to know even the first Elements of *Geometry*: Since I have not the Faculty to frame in my Mind such an *Idea* as is here describ'd. That Author acknowledges it doth 'require some Pains and Skill to Form this general *Idea* of a Triangle', *ibid.* But had he call'd to mind what he says in another place, *viz.* that '*Ideas* of mix'd Modes wherein any inconsistent *Ideas* are put together, cannot so much as exist in the Mind, *i. e.* be conceiv'd', *vid. b. iii. c. 10. s. 33. ibid.* I say, had this occur'd to his Thoughts, 'tis not improbable he'd have own'd it above all the Pains and Skill he was Master of, to form the above-mention'd *Idea* of a Triangle, which is made up of manifest, staring Contradictions. That a Man of such a clear Understanding, who thought so much, and so well, and laid so great a Stress on Clear and Determinate *Ideas*, shou'd nevertheless talk at this rate, seems very surprising. But my Wonder is lessen'd when I consider, that the Source whence this Opinion of Abstract Figures and Extension flows, is the prolific Womb which has brought forth innumerable Errors and Difficulties, in all Parts of Philosophy, and in all the Sciences. But this Matter, taken in its full Extent, were a Subject too vast and comprehensive to be insisted on in this place. I shall only observe that your Metaphysicians, and Men of Speculation, seem to have Faculties distinct from those of ordinary Men; when they talk of General or Abstracted Triangles and Circles, &c. and so peremptorily declare them to be the Subject of all the Eternal, Immutable, Universal Truths, in *Geometry*. And so much for Extension in *Abstract*.

CXXVI. Some, perhaps, may think pure Space, *Vacuum*, or Trine Dimension to be equally the *Object* of Sight and Touch. But tho' we have a very great Propension, to think the *Ideas* of Outness and Space to be the immediate *Object* of Sight; yet, if I mistake not, in the fore-going Parts of this Essay, That hath been clearly Demonstrated to be a meer Delusion, arising from the quick and sudden Suggestion of Fancy, which so closely Connects the *Idea* of Distance with those of Sight, that we are apt to think it is it self a proper and immediate *Object* of that Sense, till Reason corrects the Mistake.

CXXVII. It having been shewn, that there are no Abstract *Ideas* of Figure, and that it is impossible for us, by any Precision of Thought, to frame an *Idea* of Extension separate from all other Visible and Tangible Qualities, which shall be common both to Sight and Touch: The Question now remaining is, whether the particular Extensions, Figures, and Motions perceiv'd by Sight be of the same Kind, with the particular Extensions, Figures, and Motions perceiv'd by Touch? In answer to which, I shall venture to lay down the following Proposition, *viz. The Extension, Figures, and Motions perceiv'd by Sight are specifically Distinct from the Ideas of Touch, called by the same Names, nor is there any such thing as an Idea, or kind of Idea common to both Senses.* This Proposition may, without much Difficulty, be collected from what hath been said in several Places of this Essay. But, because it seems so remote from, and contrary to, the receiv'd Notions and settled Opinion of Mankind; I shall attempt



to demonstrate it more particularly, and at large, by the following Arguments.

CXXVIII. *First*, When upon Perception of an *Idea*, I range it under this or that sort; it is because it's perceiv'd after the same manner, or because it has a Likeness or Conformity with, or affects me in the same way as the *Ideas* of the sort I rank it under. In short, it must not be intirely new, but have something in it Old, and already perceiv'd by me: It must, I say, have so much, at least, in common with the *Ideas* I have before known and nam'd, as to make me give it the same Name with them. But it has been, if I mistake not, clearly made out, that a Man Born Blind wou'd not, at first reception of his Sight, think the things he saw were of the same Nature with the *Objects* of Touch, or had any thing in common with them; but that they were a new Set of *Ideas*, perceiv'd in a new manner, and intirely different from all he had ever perceiv'd before. So that he wou'd not call them by the same Name, nor repute them to be of the same Sort, with any thing he had hitherto known. And surely, the Judgment of such an unprejudic'd Person is more to be relied on in this Case, than the Sentiments of the generality of Men: Who in this, as in almost every thing else, suffer themselves to be guided by Custom, and the erroneous Suggestions of Prejudice, rather than Reason and sedate Reflexion.

CXXIX. *Secondly*, Light and Colours are allow'd by all to constitute a Sort or *Species*, intirely different from the *Ideas* of Touch: Nor will any Man, I presume, say they can make themselves perceiv'd by that Sense. But there is no other immediate *Object* of Sight, besides Light and Colours. It is therefore a direct Consequence, that there is no *Idea* common to both Senses.

CXXX. It is, I know, a prevailing Opinion, even amongst those who have Thought and Writ most Accurately concerning our *Ideas*, and the Ways whereby they enter into the Understanding, that something more is perceiv'd by Sight, than barely Light and Colours with their Variations. The Excellent Mr. *Locke* termeth Sight 'The most Comprehensive of all our Senses, conveying to our Minds the *Ideas* of Light and Colours, which are peculiar only to that Sense; and also the far different *Ideas* of Space, Figure, and Motion.' *Essay on Hum. Understand. b. ii. c. 9. s. 9.* Space or Distance, we have shewn, is no otherwise the *Object* of Sight than of Hearing. *Vid. Sect. XLVI.* And as for Figure and Extension, I leave it to any one, that shall calmly attend to his own clear and distinct *Ideas*, to decide whether he has any *Idea* intromitted immediately and properly by Sight, save only Light and Colours. Or whether it be possible for him, to frame in his Mind a distinct Abstract *Idea* of Visible Extension, or Figure, exclusive of all Colour; and on the other hand, whether he can conceive Colour without Visible Extension. For my own part, I must confess, I am not able to attain so great a nicety of Abstraction. I know very well that, in a strict Sense, I see nothing but Light and Colours, with their several Shades and Variations. He who beside these, doth also perceive by Sight *Ideas* far different and distinct from them, hath that Faculty in a degree more perfect and comprehensive than I can pretend to. I own indeed, that by the mediation of Light and Colours, other far different *Ideas* are suggested to my Mind. But then, upon this Score, I see no reason why the Sight shou'd be thought more Comprehensive than the Hearing: Which beside Sounds, which are peculiar to that Sense, doth by their Mediation suggest, not only Space, Figure, and Motion, but also, all other *Ideas* whatsoever that can be signified by Words.

CXXXI. *Thirdly*, It is, I think, an Axiom universally receiv'd, that *Quantities of the same Kind may be added together, and make one intire Sum*. Mathematicians add Lines together; but they do not add a Line to a Solid, or conceive it as making one Sum with a Surface. These three Kinds of Quantity being thought incapable of any such mutual Addition, and consequently of being compared together, in the several ways of Proportion, are by them, for that reason, esteem'd intirely Disparate and Heterogeneous. Now let any one try in his Thoughts, to add a Visible Line or Surface to a Tangible Line or Surface, so as to conceive them making one continu'd Sum or Whole. He that can do this, may think them Homogeneous; but he that cannot must, by the foregoing Axiom, think them Heterogeneous. I acknowledge my self to be of the latter Sort. A Blue, and a Red Line I can conceive added together into one Sum, and making one continu'd Line; but to make, in my Thoughts, one continu'd Line of a Visible and Tangible Line added together is, I find, a Task far more difficult, and even insurmountable by me: And I leave it to the Reflexion and Experience of every particular Person, to determine for himself.

CXXXII. A further Confirmation of our Tenent may be drawn from the Solution of Mr. *Molyneux's* Problem, publish'd by Mr. *Locke* in his *Essay*. Which I shall set down as it there lies, together with Mr. *Locke's* Opinion of it. '*Suppose a Man Born Blind, and now Adult, and taught by his Touch to distinguish between a Cube, and a Sphere of the same Metal, and nighly of the same Bigness, so as to tell, when he felt one and t'other, which is the Cube, and which the Sphere. Suppose then the Cube and Sphere placed on a Table, and the Blind Man to be made to See: Quære, Whether by his Sight, before he Touch'd them, he could now distinguish, and tell, which is the Globe, which the Cube. To which the acute and judicious Proposer Answers: Not. For though he has obtain'd the experience of, how a Globe, how a Cube affects his Touch; yet he has not yet attained the Experience, that what affects his Touch so or so, must affect his Sight so or so: Or that a protuberant Angle in the Cube, that pressed his Hand unequally, shall appear to his Eye, as it doth in the Cube.* I agree with this thinking Gentleman, whom I am proud to call my Friend, in his Answer to this his Problem; and am of opinion, that the Blind Man, at first Sight, would not be able with certainty to say, which was the Globe, which the Cube, whilst he only saw them.' *Essay on Human Understand. b. ii. c. 9. s. 8.*

CXXXIII. Now, if a Square Surface perceiv'd by Touch be of the same Sort, with a Square Surface perceived by Sight: It is certain the Blind Man here mention'd might know a Square Surface, as soon as he saw it. It is no more but introducing into his Mind, by a new Inlet, an *Idea* he has been already well acquainted with. Since therefore he is suppos'd to have known by his Touch, that a Cube is a Body terminated by Square Surfaces; and that a Sphere is not terminated by Square Surfaces; Upon the Supposition that a Visible and Tangible Square differ only *in Numero*, it follows, that he might know, by the unerring Mark of the Square Surfaces, which was the Cube, and which not, whilst he only saw them. We must therefore allow, either that Visible Extension and Figures are Specifically distinct, from Tangible Extension and Figures, or else, that the Solution of this Problem, given by those two very thoughtful and ingenious Men, is wrong.

CXXXIV. Much more might be laid together in Proof of the Proposition I have advanced. But what has been said is, if I mistake not, sufficient to convince any one that shall yield

a reasonable Attention. And, as for those that will not be at the Pains of a little Thought, no Multiplication of Words will ever suffice to make them understand the Truth, or rightly conceive my Meaning.

CXXXV. I cannot let go the above-mention'd Problem, without some Reflexion on it. It hath been made evident, that a Man Blind from his Birth wou'd not, at first Sight, denominate any thing he saw by the Names, he had been us'd to appropriate to *Ideas* of Touch, *vid. Sect. CVI. Cube, Square, Table*, are Words he has known applied to Things perceivable by Touch, but to Things perfectly Intangible he never knew them apply'd. Those Words, in their wonted application, always mark'd out to his Mind Bodies, or Solid Things which were perceiv'd by the Resistance they gave. But there is no Solidity, no Resistance or Protrusion perceiv'd by Sight. In short, the *Ideas* of Sight are all new Perceptions, to which there be no Names annex'd in his Mind; he cannot, therefore, understand what is said to him concerning them. And to ask, of the two Bodies he saw placed on the Table, which was the Sphere, which the Cube? were, to him, a Question downright Bantering and Unintelligible: Nothing he sees being able to suggest to his Thoughts, the *Idea* of a Body, Distance, or, in general, of any thing he had already known.

CXXXVI. 'Tis a Mistake, to think the same thing affects both Sight and Touch. If the same Angle or Square which is the *Object* of Touch, be also the *Object* of Vision: What shou'd hinder the Blind Man, at first Sight, from knowing it? For tho' the manner wherein it affects the Sight, be different from that wherein it affected his Touch; yet, there being, beside this Manner or Circumstance, which is new and unknown, the Angle or Figure which is old and known, he cannot chuse but discern it.

CXXXVII. Visible Figure and Extension having been demonstrated, to be of a Nature intirely Different and Heterogeneous, from Tangible Figure and Extension, it remains that we inquire concerning *Motion*. Now, that Visible Motion is not of the same Sort with Tangible Motion, seems to need no farther Proof, it being an evident Corollary from what we have shewn, concerning the Difference there is betwixt Visible and Tangible Extension. But for a more full and express Proof hereof, we need only observe, that one who had not yet experienced Vision, wou'd not, at first Sight, know Motion. Whence it clearly follows, that Motion perceivable by Sight is of a Sort distinct from Motion perceivable by Touch. The Antecedent I prove thus. By Touch he cou'd not perceive any Motion, but what was up or down, to the right or left, nearer or farther from him; besides these, and their several Varieties or Complications, it's impossible he shou'd have any *Idea* of Motion. He wou'd not therefore think any thing to be Motion, or give the name *Motion* to any *Idea*, which he cou'd not range under some or other, of those particular Kinds thereof. But from *Sect. XCV.* it's plain that by the meer act of Vision, he cou'd not know Motion upwards or downwards, to the right or left, or in any other possible Direction. From which I conclude, he'd not know Motion at all at first Sight. As for the *Idea* of Motion in *Abstract*, I shall not waste Paper about it, but leave it to my Reader, to make the best he can on't. To me 'tis perfectly Unintelligible.

CXXXVIII. The Consideration of Motion, may furnish a new Field for Inquiry. But since the manner wherein the Mind apprehends by Sight, the Motion of Tangible *Objects*, with the various Degrees thereof, may be easily collected, from what has been said concerning the manner, wherein that Sense doth suggest their various Distances, Magnitudes, and Situations;

I shall not enlarge any farther on this Subject: But proceed to enquire what may be alleg'd, with greatest appearance of Reason, against the Proposition we have Demonstrated to be true. For where there is so much Prejudice to be encounter'd, a bare and naked Demonstration of the Truth will scarce suffice. We must also, satisfie the Scruples that Men may Start, in favour of their preconceiv'd Notions, shew whence the Mistake arises, how it came to spread, and carefully disclose and root out those false Perswasions, that an early Prejudice might have implanted in the Mind.

CXXXIX. *First*, Therefore, it will be demanded, how Visible Extension and Figures come to be call'd by the same Name, with Tangible Extension and Figures, if they are not of the same Kind with them? It must be something more than Humour or Accident, that cou'd occasion a Custom so constant and universal as this, which has obtain'd in all Ages and Nations of the World, and amongst all Ranks of Men, the Learned as well as the Illiterate.

CXL. To which I Answer, we can no more Argue *e. g.* a Visible and Tangible Square to be of the same *Species*, from their being call'd by the same Name; than we can, that a Tangible Square and the Monosyllable consisting of Six Letters, whereby it is mark'd, are of the same Species, because they are both call'd by the same Name. It is customary to call written Words, and the Things they signify, by the same Name: For Words not being regarded in their own Nature, or otherwise than as they are marks of Things, it had been superfluous, and beside the design of Language, to have given them Names distinct from those of the Things marked by them. The same Reason holds here also. Visible Figures are the marks of Tangible Figures, and from *Sect. LIX*, it is plain, that in themselves they are little regarded, or upon any other Score than for their Connexion with Tangible Figures, which by Nature they are ordain'd to signifie. And because this Language of Nature does not vary, in different Ages or Nations, hence it is that, in all Times and Places, Visible Figures are call'd by the same Names, as the respective Tangible Figures suggested by them: And not because they are alike, or of the same sort with them.

CXLI. But say you, surely a Tangible Square is liker to a Visible Square than to a Visible Circle: It has four Angles, and as many Sides; so also has the Visible Square, but the Visible Circle has no such thing, being bounded by one uniform Curve, without right Lines or Angles; which makes it unfit to represent the Tangible Square, but very fit to represent the Tangible Circle. Whence it clearly follows, that Visible Figures are Patterns of, or of the same *Species* with, the respective Tangible Figures represented by them; that they are like unto them, and of their own Nature fitted to represent them as being of the same sort; and that they are in no respect arbitrary Signs, as Words.

CXLII. I Answer it must be acknowledg'd, the Visible Square is fitter than the Visible Circle to represent the Tangible Square, but then it is not because it's liker, or more of a Species with it. But, because the Visible Square contains in it several distinct Parts, whereby to mark the several distinct, corresponding Parts of a Tangible Square, whereas the Visible Circle doth not. The Square perceiv'd by Touch hath four distinct, equal Sides, so also hath it four distinct, equal Angles. It is therefore necessary, that the Visible Figure which shall be most proper to mark it, contain four distinct, equal Parts corresponding to the four Sides of the Tangible Square; as likewise four other distinct and equal Parts, whereby to denote the four equal Angles of the Tangible Square. And accordingly we see the Visible Figures

contain in them distinct Visible Parts answering to the distinct Tangible Parts of the Figures signify'd, or suggested by them.

CXLIII. But it will not hence follow, that any Visible Figure is like unto, or of the same *Species* with, its corresponding Tangible Figure, unless it be also shewn, that not only the Number, but also the Kind of the Parts be the same in both. To Illustrate this, I observe that Visible Figures represent Tangible Figures, much after the same manner that written Words do Sounds. Now, in this respect, Words are not Arbitrary, it not being indifferent, what written Word stands for any Sound. But it is requisite, that each Word contain in it as many distinct Characters, as there are Variations in the Sound it stands for. Thus, the single letter *a* is proper to mark one simple uniform Sound; and the Word *Adultery* is accommodated to represent the Sound annex to it, in the Formation whereof, there being Eight different Collisions, or Modifications of the Air by the Organs of Speech, each of which produces a difference of Sound, it was fit, the Word representing it shou'd consist of as many distinct Characters, thereby to mark each particular Difference or Part of the whole Sound. And yet no Body, I presume, will say, the single Letter *a* or the Word *Adultery* are like unto, or of the same *Species* with, the respective Sounds by them Represented. It is indeed Arbitrary that, in general, Letters of any Language represent Sounds at all; but when that is once agreed, it is not Arbitrary what Combination of Letters shall represent this or that particular Sound. I leave this with the Reader to pursue, and apply it in his own Thoughts.

CXLIV. It must be confest, that we are not so apt to confound other Signs with the Things signified, or to think them of the same *Species*, as we are Visible and Tangible *Ideas*. But a little Consideration will shew us how this may well be, without our supposing them of a like Nature. These Signs are constant and universal, this Connexion with Tangible *Ideas* has been learnt, at our first Entrance into the World, and ever since, almost every Moment of our Lives, it has been occurring to our Thoughts, and fastening and striking deeper on our Minds. When we observe that Signs are variable and of Human Institution, when we remember, there was a time they were not connected in our Minds, with those things they now so readily suggest; but, that their Signification was learnt by the slow Steps of Experience. This preserves us from confounding them. But, when we find the same Signs suggest the same Things all over the World; when we know they are not of Human Institution, and cannot remember that we ever learn'd their Signification; but think that at first Sight they would have suggested to us, the same Things they do now: All this perswades us they are of the same *Species* as the Things respectively represented by them, and that it is by a natural Resemblance they suggest them to our Minds.

CXLV. Add to this, that whenever we make a nice Survey of any *Object*, successively directing the *Optic Axis* to each Point thereof; there are certain Lines and Figures describ'd by the Motion of the Head or Eye; which, being in Truth perceiv'd by Feeling, do, nevertheless, so mix themselves, as it were, with the *Ideas* of Sight, that we can scarce think but they appertain to that Sense. Again, the *Ideas* of Sight enter into the Mind, several at once more distinct and unmingled, than is usual in the other Senses beside the Touch. Sounds, for Example, perceiv'd at the same Instant, are apt to coalesce, if I may so say, into one Sound. But we can perceive at the same time great variety of Visible Objects, very separate and distinct from each other. Now Tangible Extension being made up, of several distinct

coexistent parts, we may hence gather another Reason, that may dispose us to imagine a Likeness, or Analogy, between the immediate Objects of Sight and Touch. But nothing, certainly, does more contribute to blend and confound them together, than the strict and close Connexion they have with each other. We cannot open our Eyes, but the *Ideas* of Distance, Bodies, and Tangible Figures are suggested by them. So swift, and sudden, and unperceiv'd is the *Transit* from Visible to Tangible *Ideas*; that we can scarce forbear thinking 'em equally the immediate Object of Vision.

CXLVI. The Prejudice which is grounded on these, and whatever other Causes may be assign'd thereof, sticks so fast on our Understandings, that it is impossible without obstinate Striving, and Labour of the Mind, to get intirely clear of it. But then the Reluctancy we find, in rejecting any Opinion, can be no Argument of its Truth, to whoever considers what has been already shewn, with regard to the Prejudices we entertain concerning the *Distance*, *Magnitude*, and *Situation* of Objects: Prejudices so familiar to our Minds, so confirm'd and inveterate, as they will hardly give way to the clearest Demonstration.

CXLVII. Upon the whole, I think we may fairly conclude, that the proper Objects of Vision constitute the Universal Language of Nature, whereby we are instructed how to regulate our Actions, in order to attain those things, that are necessary to the Preservation and Well-being of our Bodies, as also to avoid whatever may be hurtful and destructive of them. It's by their Information that we are principally guided in all the Transactions and Concerns of Life. And the manner wherein they signify, and mark out unto us the Objects which are at a distance, is the same with that of Languages and Signs of Human Appointment; which do not suggest the things signify'd, by any Likeness or Identity of Nature, but only by an Habitual Connexion, that Experience has made us to observe between 'em.

CXLVIII. Suppose one who had always continu'd Blind, be told by his Guide, that after he has advanced so many Steps, he shall come to the Brink of a Precipice, or be stopt by a Wall; must not this to him seem very admirable and surprizing? He can't conceive how 'tis possible for Mortals, to frame such Predictions as these, which to him would seem as strange and unaccountable, as Prophecy does to others. Even they who are Blessed with the Visive Faculty, may (tho' Familiarity make it less observ'd) find therein sufficient Cause of Admiration. The wonderful Art and Contrivance wherewith it is adjusted, to those Ends and Purposes for which it was apparently design'd, the vast Extent, Number, and Variety of Objects that are, at once, with so much Ease, and Quickness, and Pleasure, suggested by it: All these afford Subject for much and pleasing Speculation; and may, if any thing, give us some Glimmering, Analogous, Prænotion of Things, that are placed beyond the certain Discovery, and Comprehension of our present State.

CXLIX. I do not design to trouble my self much with drawing Corollaries, from the Doctrine I have hitherto laid down. If it bears the Test, others may, so far as they shall think convenient, employ their Thoughts in extending it farther, and applying it to whatever Purposes it may be subservient to. Only, I cannot forbear making some Inquiry concerning the *Object* of Geometry, which the Subject we have been upon does naturally lead one to. We have shewn there's no such *Idea*, as that of Extension in Abstract, and that there are two kinds of sensible Extension and Figures, which are intirely Distinct and Heterogeneous from each other. Now, it is natural to inquire which of these is the *Object* of *Geometry*.

CL. Some things there are which, at first sight, incline one to think Geometry conversant about Visible Extension. The constant use of the Eyes, both in the Practical and Speculative Parts of that Science, doth very much induce us thereto. It would, without doubt, seem odd to a Mathematician, to go about to convince him, the Diagrams he saw upon Paper were not the Figures, or even the Likeness of the Figures, which make the Subject of the Demonstration. The contrary being held an unquestionable Truth, not only by Mathematicians, but also by those who apply themselves more particularly to the Study of *Logick*; I mean, who consider the Nature of Science, Certainty, and Demonstration: It being by them assign'd as one Reason, of the extraordinary Clearness and Evidence of Geometry, that in that Science the Reasonings are free from those Inconveniences, which attend the use of Arbitrary Signs, the very *Ideas* themselves being Copied out, and exposed to View upon Paper. But, by the bye, how well this agrees with what they likewise assert, of Abstract *Ideas* being the Object of Geometrical Demonstration, I leave to be consider'd.

CLI. To come to a Resolution in this Point, we need only observe what has been said in *Sect.* LIX, LX, LXI; where it is shewn, that Visible Extensions in themselves are little regarded, and have no settled determinate Greatness; and that Men measure altogether, by the Application of Tangible Extension to Tangible Extension. All which makes it evident, that Visible Extension and Figures are not the Object of Geometry.

CLII. It is, therefore, plain that Visible Figures are of the same Use in Geometry, that Words are. And the one may as well be accounted the *Object* of that Science, as the other; neither of them being any otherwise concern'd therein, than as they represent or suggest to the Mind the particular Tangible Figures connected with them. There is, indeed, this Difference betwixt the Signification of Tangible Figures by Visible Figures, and of *Ideas* by Words. That whereas the Latter is variable and uncertain, depending altogether on the Arbitrary Appointment of Men; the Former is fix'd, and immutably the same, in all Times and Places. A Visible Square, for Instance, suggests to the Mind the same Tangible Figure in *Europe*, that it doth in *America*. Hence it is, that the Voice of Nature, which speaks to our Eyes, is not liable to that Misinterpretation and Ambiguity, that Languages of Human Contrivance are unavoidably subjected to. From which may, in some measure, be derived that peculiar Evidence and Clearness of Geometrical Demonstrations.

CLIII. Tho' what has been said may suffice to shew what ought to be determin'd, with relation to the *Object* of Geometry; I shall nevertheless, for the fuller Illustration thereof, take into my Thoughts the Case of an Intelligence, or Unbody'd Spirit, which is suppos'd to see perfectly well, *i. e.* to have a clear Perception of the proper and immediate Objects of Sight, but to have no Sense of *Touch*. Whether there be any such Being in Nature or no, is beside my Purpose to enquire. It suffices, that the Supposition contains no Contradiction in it. Let us now examine, what Proficiency such a one may be able to make in *Geometry*. Which Speculation will lead us more clearly to see, whether the *Ideas* of Sight can possibly be the *Object* of that Science.

CLIV. First, then 'tis certain, the aforesaid Intelligence could have no *Idea* of a Solid, or Quantity of three Dimensions; which follows from its not having any *Idea* of Distance. We indeed are prone to think, that we have by Sight the *Ideas* of Space and Solids, which arises from our imagining that we do, strictly speaking, see Distance, and some parts of an

*Object* at a greater Distance than others, which has been demonstrated to be the Effect of the Experience we have had, what *Ideas* of Touch are connected with such and such *Ideas* attending Vision. But the Intelligence here spoken of is suppos'd to have no Experience of Touch. He wou'd not, therefore, judge as we do, nor have any *Idea* of Distance, Outness, or Profundity, nor consequently of Space or Body, either immediately or by Suggestion. Whence it is plain, he can have no Notion of those parts of Geometry, which relate to the Mensuration of Solids, and their Convex or Concave Surfaces, and contemplate the Properties of Lines generated by the Section of a Solid. The conceiving of any part whereof, is beyond the Reach of his Faculties.

CLV. Farther, he cannot comprehend the manner wherein Geometers describe a right Line or Circle: The Rule and Compass with their Use, being things of which it's impossible he should have any Notion. Nor is it an easier matter for him, to conceive the placing of one Plain or Angle on another, in order to prove their Equality. Since that supposes some *Idea* of Distance, or External Space. All which makes it evident, our pure Intelligence could never attain to know, so much as the first Elements of plain Geometry. And, perhaps, upon a nice Enquiry, it will be found, he cannot even have an *Idea* of Plain Figures, any more than he can of Solids. Since some *Idea* of Distance is necessary, to form the *Idea* of a Geometrical Plain, as will appear to whoever shall reflect a little on it.

CLVI. All that is properly perceiv'd by the Visive Faculty, amounts to no more than Colours with their Variations, and different Proportions of Light and Shade. But, the perpetual Mutability, and Fleetingness of those immediate Objects of Sight, render them incapable of being managed after the manner of Geometrical Figures; nor is it in any Degree useful that they should. It's true, there be divers of 'em perceiv'd at once; and more of some, and less of others. But accurately to compute their Magnitude, and assign precise determinate Proportions, between Things so Variable and Inconstant, if we suppose it possible to be done, must yet be a very trifling and insignificant Labour.

CLVII. I must confess, it seems to be the Opinion of some very Ingenious Men, that flat or plain Figures are immediate Objects of Sight, tho' they acknowledge Solids are not. And this Opinion of their's is grounded on what is observ'd in Painting, wherein (say they) the *Ideas* immediately imprinted in the Mind, are only of Plains variously colour'd, which by a sudden Act of the Judgment are changed into Solids. But, with a little Attention we shall find the Plains here mention'd, as the immediate Objects of Sight, are not Visible, but Tangible Plains. For when we say that Pictures are Plains, we mean thereby, that they appear to the *Touch* Smooth and Uniform. But then this Smoothness and Uniformity, or, in other Words, this Plainness of the Picture, is not perceiv'd immediately by Vision: For it appeareth to the Eye Various and Multiform.

CLVIII. From all which we may conclude, that Plains are no more the immediate *Object* of Sight than Solids. What we strictly see are not Solids, nor yet Plains variously colour'd; they are only Diversity of Colours. And some of these suggest to the Mind Solids, and others Plain Figures; just as they have been experienced to be connected with the one, or the other. So that we see Plains, in the same way that we see Solids: Both being equally suggested by the immediate Objects of Sight, which accordingly are themselves Denominated *Plains* and



*Solids.* But tho' they are called by the same Names, with the Things mark'd by them, they are nevertheless of a Nature intirely different, as hath been Demonstrated.

CLIX. What has been said is, if I mistake not, sufficient to Decide the Question we propos'd to Examine, concerning the Ability of a pure Spirit, such as we have describ'd, to know *Geometry*. It is, indeed, no easy matter for us to enter precisely into the Thoughts of such an Intelligence; because we cannot, without great Pains, cleverly Separate, and Disentangle in our Thoughts, the proper Objects of Sight, from those of Touch, which are Connected with them. This, indeed, in a compleat Degree, seems scarce possible to be perform'd. Which will not seem strange to us, if we consider how hard it is, for any one to hear the Words of his Native Language, which is familiar to him, pronounced in his Ears without understanding them. Tho' he endeavour to disunite the meaning from the Sound, it will nevertheless intrude into his Thoughts, and he shall find it extream Difficult, if not impossible, to put himself exactly in the Posture of a Foreigner, that never learnt the Language, so as to be affected barely with the Sounds themselves, and not perceive the Signification annexed to them.

CLX. By this time, I suppose, 'tis clear that neither Abstract, nor Visible Extension makes the *Object* of *Geometry*. The not discerning of which might, perhaps, have created some Difficulty, and useless Labour in *Mathematics*. Sure I am, that somewhat relating thereto has occur'd to my Thoughts, which, tho' after the most anxious and repeated Examination I am forced to think it true, doth, nevertheless, seem so far out of the common road of *Geometry*, that I know not, whether it may not be thought Presumption, if I shou'd make it publick in an Age, wherein that Science hath receiv'd such mighty Improvements by new Methods; great Part whereof, as well as of the Ancient Discoveries, may perhaps lose their Reputation, and much of that Ardor, with which Men study the *Abstruse and Fine Geometry* be abated, if what to me, and those few to whom I have imparted it, seems evidently True, shou'd really prove to be so.

*FINIS.*