

moon, the Moon at C, the Earth at c, *Mars* will be seen at γ , its true place, as if the Earth were at T. But then, after the Full, the Moon at D, the Earth at d; *Mars* will be seen, not at γ , but at δ ; too forward: and yet more, when the Moon (at the last Quarter) is at E, the Earth at e, and *Mars* seen at ϵ . If therefore *Mars* (when in opposition to the Sun) be found (all other allowances being made) somewhat too backward before the Full moon, and somewhat too forward after the Full-moon, (and most of all, at the Quadratures:) it will be the best confirmation of the Hypothesis. (The like may be fitted to *Mars* in other positions, *mutatis mutandis*; and so for the other Planets.)

But this proof, is of like nature as that of the Parallax of the Earths Annual Orb to prove the Copernican Hypothesis. If it can be observed, it proves the Affirmative; but if it cannot be observed, it doth not convince the Negative, but only proves that the Semidiameter of the Earths Epicycle is so small as not to make any discernable Parallax. And indeed, I doubt, that will be the issue. For the Semidiameter of this Epicycle, being little more than the Semidiameter of the Earth it self, or about $1\frac{1}{3}$ thereof (as is conjectured, in the *Hypothesis*, from the Magnitudes and Distances of the Earth and Moon compared;) and there having not as yet been observed any discernable *Parallax* of *Mars*, even in his nearest position to the Earth; it is very suspicious, that here it may prove so too. And whether any of the other Planets will be more favourable in this point, I cannot say.

ANIMADVERSIONS

Of Dr. Wallis, upon Mr. Hobs's late Book, De Principiis & Ratiocinatione Geometrarum.

These were communicated by way of Letter, written in Oxford, July 24. 1666. to an Acquaintance of the Author, as follows:

SINCE I saw you last, I have read over Mr. Hobs's Book *Contra Geometras* (or *De Principiis & Ratiocinatione Geometrarum*) which you then shewed me. A New Book of Old matter: Containing but a *Repetition* of what he had before told us, more than once; and which hath been Answered long agoe.

In which, though there be Faults enough to offer ample mat-

Q q 2

ter

ter for a large Confutation : yet I am scarce inclined to believe, that any will bestow so much pains upon it. For, if that be true, which (in his *Preface*) he saith of himself, *Aut solus insanio Ego, aut solus non insanio* : it would either be *Needless*, or to *no Purpose*. For, by his own confession, *All others*, if they be not mad themselves, ought to think *Him* so : And therefore, as to *Them*, a Confutation would be *needless* ; who, itslike, are well enough satisfied already : at least out of danger of being seduced. And, as to himself, it would be *to no purpose*. For, if *He* be the Mad man, it is not to be hoped that he will be convinced by Reason : Or, if *All We* be so ; we are in no capacity to attempt it.

But there is yet another Reason, why I think it not to need a Confutation. Because what is in it, hath been sufficiently confuted already ; (and, so Effectually ; as that he professeth himself not to Hope, that *This Age* is like to give sentence for him ; what ever *Nondum imbuta Posteritas* may do.) Nor doth there appear any Reason, why he should again Repeat it, unless he can hope, That, what was at first False, may by oft Repeating, become True.

I shall therefore, instead of a large Answer, onely give you a brief Account, *what is in it ; & where it hath been already Answered.*

The chief of what he hath to say, in his first 10 Chapters, against *Euclids* Definitions, amounts but to this, That he thinks, *Euclide* ought to have allowed his *Point* some *Bigness* ; his *Line*, some *Breadth* ; and his *Surface*, some *Thickness*.

But where in his *Dialogues*, pag. 151, 152. he solemnly undertakes to Demonstrate it ; (for it is there, his 4th *Proposition* :) his Demonstration amounts to no more but this ; That, *unless a Line be allowed some Latitude ; it is not possible that his Quadratures can be True.* For finding himself reduced to these inconveniences : 1. That his *Geometrical Constructions*, would not consist with *Arithmetical calculations*, nor with what *Archimedes* and others have long since demonstrated : 2. That the *Arch* of a Circle must be allowed to be sometimes *Shorter* than its *Chord*, and sometimes *longer* than its *Tangent* : 3. That the same *Straight Line* must be allowed, at one place onely to *Touch*, and at another place to *Cut* the same Circle : (with others of like nature ;) He findes it necessary, that these things may not seem Absurd, to allow his *Lines* some *Breadth*, (that so, as he speaks, *While a Straight Line with its Out-side doth at one place*
Touch

Touch the Circle, it may with its In-side at another place Cut it, &c.) But I should sooner take this to be a *Confutation of His Quadratures*, than a *Demonstration of the Breadth of a (Mathematical) Line*. Of which, see my *Hobbius Heautontimorumenus*, from pag. 114. to p. 119.

And what he now Adds, being to this purpose; That though *Euclid's σημειον*, which we translate, a *Point*, be not indeed *Nomen Quanti*; yet cannot this be actually represented by any thing, but what will have some Magnitude; nor can a *Painter*, no not *Apelles* himself, draw a *Line* so small, but that it will have some Breadth; nor can *Thread* be spun so Fine, but that it will have some Bigness; (pag. 2, 3, 19, 21.) is nothing to the Business; For *Euclide* doth not speak either of such *Points*, or of such *Lines*.

He should rather have considered of his own Expedienc. pag. 11. That, when one of his (*broad*) *Lines*, passing through one of his (*great*) *Points*, is supposed to cut another *Line* proposed, into two equal parts; we are to understand, the *Middle of the breadth* of that *Line*, passing through the *middle* of that *Point*, to distinguish the *Line* given into two equal parts. And he should then have considered further, that *Euclide*, by a *Line*, means no more than what *Mr. Hobs* would call the *middle of the breadth* of his; and *Euclide's Point*, is but the *Middle* of *Mr. Hobs's*. And then, for the same reason, that *Mr. Hobs's Middle* must be said to have no *Magnitude*; (For else, not the *whole Middle*, but the *Middle of the Middle*, will be *in the Middle*: And, the *Whole* will not be equal to its *Two Halves*; but Bigger than *Both*, by so much as the *Middle* comes to:) *Euclide's Lines* must as well be said to have no Breadth; and his *Points* no Bigness.

In like manner, When *Euclide* and others do make the *Terme* or *End* of a *Line*, a *Point*: If this *Point* have *Parts* or *Greatness*, then not the *Point*, but the *Outer-Half* of this *Point* ends the *Line*, (for, that the *Inner-Half* of that *Point* is not at the *End*, is manifest, because the *Outer-Half* is beyond it:) And again, if that *Outer Half* have *Parts* also; not this, but the *Outer part* of it, and again the *Outer part* of that *Outer part*, (and so in *infinitum*.) So that, as long as *Any thing of Line* remains, we are not yet at the *End*: And consequently, if we must have passed the *whole Length*, before we be at the *End*; then that *End* (or *Punctum terminans*) has *nothing of Length*; (for, when the *whole Length* is past, there is nothing of it left. And if *Mr. Hobs* tells us (as pag. 3.) that this

End

End is not *Punctum*, but only *Signum* (which he does allow *non esse nomen Quanti*) even *this* will serve our turn well enough. *Euclid's* Σημείον, which some Interpreters render by *Signum*, others have thought fit (with *Tully*) to call *Punctum*: But if *Mr. Hobs* like not that name, we will not contend about it. Let it be *Punctum*, or let it be *Signum* (or, if he please, he may call it *Vexillum*.) But then he is to remember, that this is only a Controversie in *Grammar*, not in *Mathematicks*: And his Book should have been intituled *Contra Grammaticos*, not, *Contra Geometras*. Nor is it *Euclide*, but *Cicero*, that is concern'd, in rendring the Greek Σημείον, by the Latine *Punctum*, not by *Mr. Hobs's Signum*. The Mathematician is equally content with either word.

What he saith here, *Chap. 8. § 19.* (and in his fifth *Dial. p. 105. &c.*) concerning the *Angle of Contact*; amounts but to thus much, That, by the *Angle of Contact*, he doth not mean either what *Euclide* calls an *Angle*, or any thing of that kind; (and therefore says nothing to the purpose of what was in controversie between *Clavius* and *Peletarius*, when he says, that *An Angle of Contact hath some magnitude*;) But, that by the *Angle of Contact*, he understands the *Crookedness of the Arch*; and in saying, *the Angle of Contact hath some magnitude*, his meaning is, that the *Arch of a Circle hath some crookedness*, or, is a *crooked line*: and that, of equal Arches, That is the more crooked, whose chord is shortest: which I think none will deny; (for who ever doubted, but that a *circular Arch is crooked*? or, that, of such Arches, equal in length, *That is the more crooked, whose ends by bowing are brought nearest together*?) But, why the *Crookedness of an Arch*, should be called an *Angle of Contact*; I know no other reason, but, because *Mr. Hobs* loves to call that *Chalk*, which others call *Cheese*. Of this see my *Hobbis Heauton-timorumenus*, from *pag. 88. to p. 100.*

What he saith here of *Rations* or *Proportions*, and their *Calculus*; for 8. Chapters together, (*Chap. 11. &c.*) is but the same for substance, what he had formerly said in his 4th. Dialogue, and elsewhere. To which you may see a full Answer, in my *Hobbis Heauton-tim.* from *pag. 49. to p. 88.* which I need not here repeat.

Onely (as a *Specimen* of *Mr. Hobs's Candour*, in Falsifications) you may by the way observe, how he deals with a Demonstration of *Mr. Rook's*, in confutation of *Mr. Hobs's Duplication* of the Cube: Which when he had repeated, *pag. 43.* He doth then (that it might seem absurd) change those words, *æquales quatuor*

quatuor cubis DV; (pag. 43. line 33.) into these (p. 44. l. 5.) aequalia quatuor Lineis, nempe quadruplus Recta DV: And would thence perswade you, that Mr. Rook had assigned a Solide, equal to a Line. But Mr. Rook's Demonstration was clear enough for Mr. Hobbs's Comment. Nor do I know any Mathematician (unless you take Mr. Hobbs to be one) who thinks that a Line multiplied by a Number will make a Square; (what ever Mr. Hobbs is pleased to teach us.) But, That a Number multiplied by a Number, may make a Square Number; and, That a Line drawn into a Line may make a square Figure, Mr. Hobbs (if he were, what he would be thought to be) might have known before now. Or, (if he had not before known it) he might have learned, (by what I shew him upon a like occasion, in my *Hib. Heant.* pag. 142. 143. 144.) How to understand that I language, without an Absurdity.

Just in the same manner he doth, in the next page, deal with *Clavius*. For having given us his words, pag. 45 l. 3. 4. *Dico hanc Lineam Perpendicularitatem extra circulum cadere* (because neither *intra Circulum*, nor *in Peripheria*;) He doth, when he would shew an error, first make one, by falsifying his words, line 15. where instead of *Lineam Perpendicularitatem*, he substitutes *Punctum A*. As if *Euclide* or *Clavius* had denied the Point *A*. (the utmost point of the *Radius*,) to be in the Circumference: Or, as if Mr. Hobbs, by proving the Point *A*, to be in the Circumference, had thereby proved, that the *Perpendicular Tangent A E* had also lyen in the Circumference of the Circle. But this is a Trade, which Mr. Hobbs doth drive so often, as if he were as well faulty in his *Morals*, as in his *Mathematicks*.

The *Quadrature of a Circle*, which here he gives us, *Chap. 20. 21. 23.* is one of those *Twelve* of his, which in my *Hobbsius Heanton-timorumensis* (from pag. 104. to pag. 119) are already confuted: And is the *Ninth* in order (as if there rank them) which is particularly considered, pag. 106. 107. 108. I call it *One*, because he takes it so to be; though it might as well be called *Two*. For, as there, so here, it consisteth of *Two* branches, which are Both *False*; and each overthrow the other. For if the *Arch of a Quadrant* be equal to the *Aggregate of the Semidiameter and of the Tangent of 30. Degrees*, (as he would *Here* have it, in *Chap. 20.* and *There*, in the close of *Prop. 27.*;) Then is it not equal to that *Line*, whose *Square is equal to Ten Squares of the Semiradius*, (as, *There*, he would have it, in *Prop. 28.* and, *Here*, in *Chap. 23.*;) And if it be equal to *This*, then not to *That*. For *This*, and *That*, are not equal: As I then demonstrated; and need not now repeat it.

The grand Fault of his Demonstration (*Chap. 30.*) wherewith he would now New-vamp his old *False* quadrature; lyes in those words *Page 40. line 30, 31. Quod impossibile est nisi ba transeat per c.* which is no impossibility at all. For though he first bid us draw the *Line R c*, and afterwards the *Line R d*: Yet, Because he hath no where proved (nor is it true) that these two are the same *Line*; (that is, that the point *d* lyes in the *Line R c*, or that *R c* passeth through *d*;) His proving that *R d* cuts off from *ab* a *Line equal to the line of B c*, doth not prove, that *ab* passeth through *c*: For this it may well do, though *ab* lye under *c*, (vid. in case *d* lye beyond the line *R c*, that is, further from *A*;) or though it lye above *c*, (vid. in case *d* be nearer, than *R c*, to the point *A*.) And therefore, unless he first prove (which he cannot do) that *A d* (a sixth part of *A D*) doth just reach to the line *R c* and no further; he onely proves
that

that a sixth part of ab is equal to the Line of Bc . But, whether it lye above it, or below it, or (as Mr. Hobs would have it) just upon it; this argument doth not conclude. (And therefore *Hagenius's* assertion, which Mr. *Hobs*, *Chap.* 21. would have give way to this Demonstration, doth, notwithstanding this, remain safe enough.)

His demonstration of *Chap* 23. (where he would prove, that the aggregate of the Radius and of the Tangent of 30. Degrees is equal to a Line, whose square is equal to 10 Squares of the Semiradius;) is confuted not only by me, (in the place forecited; where this is proved to be impossible;) but by himself also, in this same *Chap.* pag. 59 (where he proves sufficiently and doth confesse, that this demonstration, and the 47. Prop. of the first of *Euclide*, cannot be both true.) But, (which is worst of all;) whether *Euclid's* Proposition be False or True, his demonstration must needs be False. For he is in this Dilemma: If that Proposition be True, his demonstration is False, for he grants that they cannot be both True, page 59 line 21. 22. And again, if that Proposition be False, his Demonstration is so too; for *This* depends upon *That*, page 55. line 22. and therefore must fall with it.

But the Fault is obvious in His Demonstration (not in *Euclid's* Proposition:) The grand Fault of it (though there are more) lyes in those words, page 56. line 26. *Erit ergo MO minus quam MR*. Where, instead of *minus*, he should have said *majus*. And when he hath mended that Error; he will find, that the *major* in page 56. line penult, will very well agree with *majorem* in page 57. line 1 (where the Printer hath already mended the Fault to his hand) and then the *Falsum ergo* will vanish.

His Section of an Angle in *ratione data*; *Chap.* 22. hath no other foundation, than his supposed *Quadrature* of *Chap.* 20. And therefore, that being false; this must fall with it. It is just the same with that of his 6. Dialogue. *Prop.* 46. which (besides that it wants a foundation) how absurd it is, I have already shewed; in my *Hobbins Heanton timor.* page 119. 120.

His *Appendix*, wherein he undertakes to shew a Method of finding any number of mean Proportionals, between two Lines given: Depends upon the supposed Truth of his 22. Chapter; about *Dividing an Arch in any proportion given*: (As himself professeth: and as is evident by the Construction; which supposeth such a Section.) And therefore, that failing, this falls with it.

And yet this is otherwise faulty, though *that* should be supposed True. For, In the first Demonstration; page 67. line 12. *Producta Lf incidit in I*; is not proved; nor doth it follow from his *Quoniam igitur*.

In the second Demonstration; page 68. line 34 35. *Resta Lf incidit in x*; is not proved; nor doth it follow from his *Quare*.

In his third Demonstration; page 71: line 7. *Producta YP transibit per M*; is said *gratis*; nor is any proof offered for it. And so this whole structure falls to the ground. And withall, the *Prop.* 47. *El.* 1 doth still stand fast (which he tells us, page 59, 61, 78. must have Fallen, if his Demonstrations had stood:.) And so, *Geometry* and *Arithmetick* do still agree, which (he tells us, page 78: line 10.) had otherwise been at odds.

And this (though much more might have been said,) is as much as need to be said against that Piece.