

Part II: Of the ideas of space and time

Section I. Of the infinite divisibility of our idea of space and time

Whatever has the air of a paradox, and is contrary to the first and most unprejudic'd notions of mankind is often greedily embrac'd by philosophers, as shewing the superiority of their science, which cou'd discover opinions so remote from vulgar conception. On the other hand, any thing propos'd to us, which causes surprize and admiration, gives such a satisfaction to the mind, that it indulges itself in those agreeable emotions, and will never be persuaded that its pleasure is entirely without foundation. From these dispositions in philosophers and their disciples arises that mutual complaisance betwixt them; while the former furnish such plenty of strange and unaccountable opinions, and the latter so readily believe them. Of this mutual complaisance I cannot give a more evident instance than in the doctrine of infinite divisibility, with the examination of which I shall begin this subject of the ideas of space and time.

'Tis universally allow'd, that the capacity of the mind is limited, and can never attain a full and adequate conception of infinity: And tho' it were not allow'd, 'twou'd be sufficiently evident from the plainest observation and experience. 'Tis also obvious, that whatever is capable of being divided *in infinitum*, must consist of an infinite number of parts, and that 'tis impossible to set any bounds to the number of parts, without setting bounds at the same time to the division. It requires scarce any induction to conclude from hence, that the *idea*, which we form of any finite quality, is not infinitely divisible, but that by proper distinctions and separations we may run up this idea to inferior ones, which will be perfectly simple and indivisible. In rejecting the infinite capacity of the mind, we suppose it may arrive at an end in the division of its ideas; nor are there any possible means of evading the evidence of this conclusion.

'Tis therefore certain, that the imagination reaches a *minimum*, and may raise up to itself an idea, of which it cannot conceive any sub-division, and which cannot be diminished without a total annihilation. When you tell me of the thousandth and ten thousandth part of a grain of sand, I have a distinct idea of these numbers and of their different proportions; but the images, which I form in my mind to represent the things themselves, are nothing different from each other, nor inferior to that image, by which I represent the grain of sand itself, which is suppos'd so vastly to exceed them. What consists of parts is distinguishable into them, and what is distinguishable is separable. But whatever we may imagine of the thing, the idea of a grain of sand is not distinguishable, nor separable into twenty, much less into a thousand, ten thousand, or an infinite number of different ideas.

'Tis the same case with the impressions of the senses as with the ideas of the imagination. Put a spot of ink upon paper, fix your eye upon that spot, and retire to such a distance, that at last you lose sight of it; 'tis plain, that the moment before it vanish'd the image or impression was perfectly indivisible. 'Tis not for want of rays of light striking on our eyes, that the minute parts of distant bodies convey not any sensible impression; but because they are remov'd beyond that distance, at which their impressions were reduc'd to a *minimum*, and were incapable of any farther diminution. A microscope or telescope, which renders them visible, produces not any new rays of light, but only spreads those, which always

flow'd from them; and by that means both gives parts to impressions, which to the naked eye appear simple and un compounded, and advances to a *minimum*, what was formerly imperceptible.

We may hence discover the error of the common opinion, that the capacity of the mind is limited on both sides, and that 'tis impossible for the imagination to form an adequate idea, of what goes beyond a certain degree of minuteness as well as of greatness. Nothing can be more minute, than some ideas, which we form in the fancy; and images, which appear to the senses; since there are ideas and images perfectly simple and indivisible. The only defect of our senses is, that they give us disproportion'd images of things, and represent as minute and un compounded what is really great and compos'd of a vast number of parts. This mistake we are not sensible of; but taking the impressions of those minute objects, which appear to the senses, to be equal or nearly equal to the objects, and finding by reason, that there are other objects vastly more minute, we too hastily conclude, that these are inferior to any idea of our imagination or impression of our senses. This however is certain, that we can form ideas, which shall be no greater than the smallest atom of the animal spirits of an insect a thousand times less than a mite: And we ought rather to conclude, that the difficulty lies in enlarging our conceptions so much as to form a just notion of a mite, or even of an insect a thousand times less than a mite. For in order to form a just notion of these animals, we must have a distinct idea representing every part of them; which, according to the system of infinite divisibility, is utterly impossible, and according to that of indivisible parts or atoms, is extremely difficult, by reason of the vast number and multiplicity of these parts.

Section II. Of the infinite divisibility of space and time

Wherever ideas are adequate representations of objects, the relations, contradictions and agreements of the ideas are all applicable to the objects; and this we may in general observe to be the foundation of all human knowledge. But our ideas are adequate representations of the most minute parts of extension; and thro' whatever divisions and subdivisions we may suppose these parts to be arriv'd at, they can never become inferior to some ideas, which we form. The plain consequence is, that whatever *appears* impossible and contradictory upon the comparison of these ideas, must be *really* impossible and contradictory, without any farther excuse or evasion.

Every thing capable of being infinitely divided contains an infinite number of parts; otherwise the division would be stopt short by the indivisible parts, which we should immediately arrive at. If therefore any finite extension be infinitely divisible, it can be no contradiction to suppose, that a finite extension contains an infinite number of parts: And *vice versa*, if it be a contradiction to suppose, that a finite extension contains an infinite number of parts, no finite extension can be infinitely divisible. But that this latter supposition is absurd, I easily convince myself by the consideration of my clear ideas. I first take the least idea I can form of a part of extension, and being certain that there is nothing more minute than this idea, I conclude, that whatever I discover by its means must be a real quality of extension. I then repeat this idea once, twice, thrice, &c. and find the compound idea of extension, arising from its repetition, always to augment, and become double, triple, quadruple, &c. till at last it swells up to a considerable bulk, greater or smaller, in proportion as I repeat more or less the same idea. When I stop in the addition of parts, the idea of extension ceases to augment; and were I to carry on the addition *in infinitum*, I clearly perceive, that the idea of extension must also become infinite. Upon the whole, I conclude, that the idea of an infinite number of parts is individually the same idea

with that of an infinite extension; that no finite extension is capable of containing an infinite number of parts; and consequently that no finite extension is infinitely divisible.¹ I may subjoin another argument propos'd by a noted author², which seems to me very strong and beautiful. 'Tis evident, that existence in itself belongs only to unity, and is never applicable to number, but on account of the unites, of which the number is compos'd. Twenty men may be said to exist; but 'tis only because one, two, three, four, &c. are existent; and if you deny the existence of the latter, that of the former falls of course. 'Tis therefore utterly absurd to suppose any number to exist, and yet deny the existence of unites; and as extension is always a number, according to the common sentiment of metaphysicians, and never resolves itself into any unite or indivisible quantity, it follows, that extension can never at all exist. 'Tis in vain to reply, that any determinate quantity of extension is an unite; but such-a-one as admits of an infinite number of fractions, and is inexhaustible in its sub-divisions. For by the same rule these twenty men *may be consider'd as an unite*. The whole globe of the earth, nay the whole universe *may be consider'd as an unite*. That term of unity is merely a fictitious denomination, which the mind may apply to any quantity of objects it collects together; nor can such an unity any more exist alone than number can, as being in reality a true number. But the unity, which can exist alone, and whose existence is necessary to that of all number, is of another kind, and must be perfectly indivisible, and incapable of being resolved into any lesser unity.

All this reasoning takes place with regard to time; along with an additional argument, which it may be proper to take notice of. 'Tis a property inseparable from time, and which in a manner constitutes its essence, that each of its parts succeeds another, and that none of them, however contiguous, can ever be co-existent. For the same reason, that, the year 1737 cannot concur with the present year 1738, every moment must be distinct from, and posterior or antecedent to another. 'Tis certain then, that time, as it exists, must be compos'd of indivisible moments. For if in time we could never arrive at an end of division, and if each moment, as it succeeds another, were not perfectly single and indivisible, there would be an infinite number of coexistent moments, or parts of time; which I believe will be allow'd to be an arrant contradiction.

The infinite divisibility of space implies that of time, as is evident from the nature of motion. If the latter, therefore, be impossible, the former must be equally so.

I doubt not but it will readily be allow'd by the most obstinate defender of the doctrine of infinite divisibility, that these arguments are difficulties, and that 'tis impossible to give any answer to them which will be perfectly clear and satisfactory. But here we may observe, that nothing can be more absurd, than this custom of calling a *difficulty* what pretends to be a *demonstration*, and endeavouring by that means to elude its force and evidence. 'Tis not in demonstrations as in probabilities, that difficulties can take place, and one argument counter-balance another, and diminish its authority. A demonstration, if just, admits of no opposite difficulty; and if not just, 'tis a mere sophism, and consequently can never be a difficulty. 'Tis either irresistible, or has no manner of force. To talk therefore of objections and replies, and balancing of arguments in such a question as this, is to confess, either that human reason is nothing but a play of words, or that the person himself, who talks so, has not a capacity equal to such subjects. Demonstrations may be difficult to be comprehended, because of the abstractedness of the subject; but can never have any such difficulties as will weaken their authority, when once they are comprehended.

'Tis true, mathematicians are wont to say, that there are here equally strong arguments on the other side of the question, and that the doctrine of indivisible points is also liable to unanswerable objections. Before I examine these arguments and objections in detail, I will here take them in a body, and

endeavour by a short and decisive reason to prove at once, that 'tis utterly impossible they can have any just foundation.

'Tis an establish'd maxim in metaphysics, *That whatever the mind clearly conceives includes the idea of possible existence*, or in other words, *that nothing we imagine is absolutely impossible*. We can form the idea of a golden mountain, and from thence conclude that such a mountain may actually exist. We can form no idea of a mountain without a valley, and therefore regard it as impossible.

Now 'tis certain we have an idea of extension; for otherwise why do we talk and reason concerning it? 'Tis likewise certain, that this idea, as conceiv'd by the imagination, tho' divisible into parts or inferior ideas, is not infinitely divisible, nor consists of an infinite number of parts: For that exceeds the comprehension of our limited capacities. Here then is an idea of extension, which consists of parts or inferior ideas, that are perfectly indivisible: consequently this idea implies no contradiction: consequently 'tis possible for extension really to exist conformable to it: and consequently all the arguments employ'd against the possibility of mathematical points are mere scholastic quibbles, and unworthy of our attention.

These consequences we may carry one step farther, and conclude that all the pretended demonstrations for the infinite divisibility of extension are equally sophistical; since 'tis certain these demonstrations cannot be just without proving the impossibility of mathematical points; which 'tis an evident absurdity to pretend to.

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1. It has been objected to me, that infinite divisibility supposes only an infinite number of *proportional* not of *aliquot* parts, and that an infinite number of proportional parts does not form an infinite extension. But this distinction is entirely frivolous. Whether these parts be call'd *aliquot* or *proportional*, they cannot be inferior to those minute parts we conceive; and therefore cannot form a less extension by their conjunction.
 2. Mons. *Malesieu*.

Section III. Of the other qualities of our ideas of space and time

No discovery cou'd have been made more happily for deciding all controversies concerning ideas, than that above mention'd, that impressions always take the precedence of them, and that every idea, with which the imagination is furnish'd, first makes its appearance in a correspondent impression. These latter perceptions are all so clear and evident, that they admit of no controversy; tho' many of our ideas are so obscure, that 'tis almost impossible even for the mind, which forms them, to tell exactly their nature and composition. Let us apply this principle, in order to discover farther the nature of our ideas of space and time.

Upon opening my eyes, and turning them to the surrounding objects, I perceive many visible bodies; and upon shutting them again, and considering the distance betwixt these bodies, I acquire the idea of extension. As every idea is deriv'd from some impression, which is exactly similar to it, the impressions similar to this idea of extension, must either be some sensations deriv'd from the sight, or some internal impressions arising from these sensations.

Our internal impressions are our passions, emotions, desires and aversions; none of which, I believe, will ever be asserted to be the model, from which the idea of space is deriv'd. There remains therefore nothing but the senses, which can convey to us this original impression. Now what impression do our senses here convey to us? This is the principal question, and decides without appeal concerning the nature of the idea.

The table before me is alone sufficient by its view to give me the idea of extension. This idea, then, is borrow'd from, and represents some impression, which this moment appears to the senses. But my senses convey to me only the impressions of colour'd points, dispos'd in a certain manner. If the eye is sensible of any thing farther, I desire it may be pointed out to me. But if it be impossible to shew any thing farther, we may conclude with certainty, that the idea of extension is nothing but a copy of these colour'd points, and of the manner of their appearance.

Suppose that in the extended object, or composition of colour'd points, from which we first receiv'd the idea of extension, the points were of a purple colour; it follows, that in every repetition of that idea we wou'd not only place the points in the same order with respect to each other, but also bestow on them that precise colour, with which alone we are acquainted. But afterwards having experience of the other colours of violet, green, red, white, black, and of all the different compositions of these, and finding a resemblance in the disposition of colour'd points, of which they are compos'd, we omit the peculiarities of colour, as far as possible, and found an abstract idea merely on that disposition of points, or manner of appearance, in which they agree. Nay even when the resemblance is carry'd beyond the objects of one sense, and the impressions of touch are found to be similar to those of sight in the disposition of their parts; this does not hinder the abstract idea from representing both, upon account of their resemblance. All abstract ideas are really nothing but particular ones, consider'd in a certain light; but being annexed to general terms, they are able to represent a vast variety, and to comprehend objects, which, as they are alike in some particulars, are in others vastly wide of each other.

The idea of time, being deriv'd from the succession of our perceptions of every kind, ideas as well as impressions, and impressions of reflection as well as of sensation, will afford us an instance of an abstract idea, which comprehends a still greater variety than that of space, and yet is represented in fancy by some particular individual idea of a determinate quantity and quality.

As 'tis from the disposition of visible and tangible objects we receive the idea of space, so from the succession of ideas and impressions we form the idea of time, nor is it possible for time alone ever to make its appearance, or be taken notice of by the mind. A man in a sound sleep, or strongly occupy'd with one thought, is insensible of time; and according as his perceptions succeed each other with greater or less rapidity, the same duration appears longer or shorter to his imagination. It has been remark'd by a ¹ great philosopher, that our perceptions have certain bounds in this particular, which are fix'd by the original nature and constitution of the mind, and beyond which no influence of external objects on the senses is ever able to hasten or retard our thought. If you wheel about a burning coal with rapidity, it will present to the senses an image of a circle of fire; nor will there seem to be any interval of time betwixt its revolutions; meerly because 'tis impossible for our perceptions to succeed each other with the same rapidity, that motion may be communicated to external objects. Wherever we have no successive perceptions, we have no notion of time, even tho' there be a real succession in the objects. From these phænomena, as well as from many others, we may conclude, that time cannot make its appearance to the mind, either alone, or attended with a steady unchangeable object, but is always discover'd by some *perceivable* succession of changeable objects.

To confirm this we may add the following argument, which to me seems perfectly decisive and convincing. 'Tis evident, that time or duration consists of different parts: For otherwise we cou'd not conceive a longer or shorter duration. 'Tis also evident, that these parts are not co-existent: For that quality of the co-existence of parts belongs to extension, and is what distinguishes it from duration. Now as time is compos'd of parts, that are not co-existent; an unchangeable object, since it produces none but co-existent impressions, produces none that can give us the idea of time; and consequently that idea must be deriv'd from a succession of changeable objects, and time in its first appearance can never be sever'd from such a succession.

Having therefore found, that time in its first appearance to the mind is always conjoin'd with a succession of changeable objects, and that otherwise it can never fall under our notice, we must now examine whether it can be *conceiv'd* without our conceiving any succession of objects, and whether it can alone form a distinct idea in the imagination.

In order to know whether any objects, which are join'd in impression, be separable in idea, we need only consider, if they be different from each other; in which case, 'tis plain they may be conceiv'd apart. Every thing, that is different, is distinguishable; and every thing, that is distinguishable, may be separated, according to the maxims above-explain'd. If on the contrary they be not different, they are not distinguishable; and if they be not distinguishable, they cannot be separated. But this is precisely the case with respect to time, compar'd with our successive perceptions. The idea of time is not deriv'd from a particular impression mix'd up with others, and plainly distinguishable from them; but arises altogether from the manner, in which impressions appear to the mind, without making one of the number. Five notes play'd on a flute give us the impression and idea of time; tho' time be not a sixth impression, which presents itself to the hearing or any other of the senses. Nor is it a sixth impression, which the mind by reflection finds in itself. These five sounds making their appearance in this particular manner, excite no emotion in the mind, nor produce an affection of any kind, which being observ'd by it can give rise to a new idea. For *that* is necessary to produce a new idea of reflection, nor can the mind, by revolving over a thousand times all its ideas of sensation, ever extract from them any new original idea, unless nature has so fram'd its faculties, that it feels some new original impression arise from such a contemplation. But here it only takes notice of the *manner*, in which the different sounds make their appearance; and that it may afterwards consider without considering these particular sounds, but may conjoin it with any other objects. The ideas of some objects it certainly must have, nor is it possible for it without these ideas ever to arrive at any conception of time; which since it appears not as any primary distinct impression, can plainly be nothing but different ideas, or impressions, or objects dispos'd in a certain manner, that is, succeeding each other.

I know there are some who pretend, that the idea of duration is applicable in a proper sense to objects, which are perfectly unchangeable; and this I take to be the common opinion of philosophers as well as of the vulgar. But to be convinc'd of its falsehood we need but reflect on the foregoing conclusion, that the idea of duration is always deriv'd from a succession of changeable objects, and can never be convey'd to the mind by any thing stedfast and unchangeable. For it inevitably follows from thence, that since the idea of duration cannot be deriv'd from such an object, it can never in any propriety or exactness be apply'd to it, nor can any thing unchangeable be ever said to have duration. Ideas always represent the objects or impressions, from which they are deriv'd, and can never without a fiction represent or be apply'd to any other. By what fiction we apply the idea of time, even to what is unchangeable, and suppose, as is common, that duration is a measure of rest as well as of motion, we shall consider ² afterwards.

There is another very decisive argument, which establishes the present doctrine concerning our ideas of space and time, and is founded only on that simple principle, *that our ideas of them are compounded of parts, which are indivisible*. This argument may be worth the examining.

Every idea, that is distinguishable, being also separable, let us take one of those simple indivisible ideas, of which the compound one of *extension* is form'd, and separating it from all others, and considering it apart, let us form a judgment of its nature and qualities.

'Tis plain it is not the idea of extension. For the idea of extension consists of parts; and this idea, according to the supposition, is perfectly simple and indivisible. Is it therefore nothing? That is absolutely impossible. For as the compound idea of extension, which is real, is compos'd of such ideas; were these so many non-entities, there wou'd be a real existence compos'd of non-entities; which is absurd. Here therefore I must ask, *What is our idea of a simple and invisible point?* No wonder if my answer appear somewhat new, since the question itself has scarce ever yet been thought of. We are wont to dispute concerning the nature of mathematical points, but seldom concerning the nature of their ideas.

The idea of space is convey'd to the mind by two senses, the sight and touch; nor does any thing ever appear extended, that is not either visible or tangible. That compound impression, which represents extension, consists of several lesser impressions, that are indivisible to the eye or feeling, and may be call'd impressions of atoms or corpuscles endow'd with colour and solidity. But this is not all. 'Tis not only requisite, that these atoms shou'd be colour'd or tangible, in order to discover themselves to our senses; 'tis also necessary we shou'd preserve the idea of their colour or tangibility in order to comprehend them by our imagination. There is nothing but the idea of their colour or tangibility, which can render them conceivable by the mind. Upon the removal of the ideas of these sensible qualities, they are utterly annihilated to the thought or imagination.

Now such as the parts are, such is the whole. If a point be not consider'd as colour'd or tangible, it can convey to us no idea; and consequently the idea of extension, which is compos'd of the ideas of these points, can never possibly exist. But if the idea of extension really can exist, as we are conscious it does, its parts must also exist; and in order to that, must be consider'd as colour'd or tangible. We have therefore no idea of space or extension, but when we regard it as an object either of our sight or feeling.

The same reasoning will prove, that the indivisible moments of time must be fill'd with some real object or existence, whose succession forms the duration, and makes it be conceivable by the mind.

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1. Mr. *Locke*.
 2. Sect. v (p. 65).

Section IV. Objections answer'd

Our system concerning space and time consists of two parts, which are intimately connected together. The first depends on this chain of reasoning. The capacity of the mind is not infinite; consequently no idea of extension or duration consists of an infinite number of parts or inferior ideas, but of a finite number, and these simple and indivisible: 'Tis therefore possible for space and time to exist

conformable to this idea: And if it be possible, 'tis certain they actually do exist conformable to it; since their infinite divisibility is utterly impossible and contradictory.

The other part of our system is a consequence of this. The parts, into which the ideas of space and time resolve themselves, become at last indivisible; and these indivisible parts, being nothing in themselves, are inconceivable when not fill'd with something real and existent. The ideas of space and time are therefore no separate or distinct ideas, but merely those of the manner or order, in which objects exist: Or, in other words, 'tis impossible to conceive either a vacuum and extension without matter, or a time, when there was no succession or change in any real existence. The intimate connexion betwixt these parts of our system is the reason why we shall examine together the objections, which have been urg'd against both of them, beginning with those against the finite divisibility of extension.

I. The first of these objections, which I shall take notice of, is more proper to prove this connexion and dependence of the one part upon the other, than to destroy either of them. It has often been maintain'd in the schools, that extension must be divisible, *in infinitum*, because the system of mathematical points is absurd; and that system is absurd, because a mathematical point is a non-entity, and consequently can never by its conjunction with others form a real existence. This wou'd be perfectly decisive, were there no medium betwixt the infinite divisibility of matter, and the non-entity of mathematical points. But there is evidently a medium, *viz.* the bestowing a colour or solidity on these points; and the absurdity of both the extremes is a demonstration of the truth and reality of this medium. The system of *physical* points, which is another medium, is too absurd to need a refutation. A real extension, such as a physical point is suppos'd to be, can never exist without parts, different from each other; and wherever objects are different, they are distinguishable and separable by the imagination.

II. The second objection is deriv'd from the necessity there wou'd be of *penetration*, if extension consisted of mathematical points. A simple and indivisible atom, that touches another, must necessarily penetrate it; for 'tis impossible it can touch it by its external parts, from the very supposition of its perfect simplicity, which excludes all parts. It must therefore touch it intimately, and in its whole essence, *secundum se, tota, & totaliter*; which is the very definition of penetration. But penetration is impossible: Mathematical points are of consequence equally impossible.

I answer this objection by substituting a juster idea of penetration. Suppose two bodies containing no void within their circumference, to approach each other, and to unite in such a manner that the body, which results from their union, is no more extended than either of them; 'tis this we must mean when we talk of penetration. But 'tis evident this penetration is nothing but the annihilation of one of these bodies, and the preservation of the other, without our being able to distinguish particularly which is preserv'd and which annihilated. Before the approach we have the idea of two bodies. After it we have the idea only of one. 'Tis impossible for the mind to preserve any notion of difference betwixt two bodies of the same nature existing in the same place at the same time.

Taking then penetration in this sense, for the annihilation of one body upon its approach to another, I ask any one, if he sees a necessity, that a colour'd or tangible point shou'd be annihilated upon the approach of another colour'd or tangible point? On the contrary, does he not evidently perceive, that from the union of these points there results an object, which is compounded and divisible, and may be distinguish'd into two parts, of which each preserves its existence distinct and separate, notwithstanding its contiguity to the other? Let him aid his fancy by conceiving these points to be of different colours, the better to prevent their coalition and confusion. A blue and a red point may surely

lie contiguous without any penetration or annihilation. For if they cannot, what possibly can become of them? Whether shall the red or the blue be annihilated? Or if these colours unite into one, what new colour will they produce by their union?

What chiefly gives rise to these objections, and at the same time renders it so difficult to give a satisfactory answer to them, is the natural infirmity and unsteadiness both of our imagination and senses, when employ'd on such minute objects. Put a spot of ink upon paper, and retire to such a distance, that the spot becomes altogether invisible; you will find, that upon your return and nearer approach the spot first becomes visible by short intervals; and afterwards becomes always visible; and afterwards acquires only a new force in its colouring without augmenting its bulk; and afterwards, when it has encreas'd to such a degree as to be really extended, 'tis still difficult for the imagination to break it into its component parts, because of the uneasiness it finds in the conception of such a minute object as a single point. This infirmity affects most of our reasonings on the present subject, and makes it almost impossible to answer in an intelligible manner, and in proper expressions, many questions which may arise concerning it.

III. There have been many objections drawn from the *mathematics* against the indivisibility of the parts of extension; tho' at first sight that science seems rather favourable to the present doctrine; and if it be contrary in its *demonstrations*, 'tis perfectly conformable in its *definitions*. My present business then must be to defend the definitions, and refute the demonstrations.

A surface is *defin'd* to be length and breadth without depth: A line to be length without breadth or depth: A point to be what has neither length, breadth nor depth. 'Tis evident that all this is perfectly unintelligible upon any other supposition than that of the composition of extension by indivisible points or atoms. How else cou'd any thing exist without length, without breadth, or without depth? Two different answers, I find, have been made to this argument; neither of which is in my opinion satisfactory. The first is, that the objects of geometry, those surfaces, lines and points, whose proportions and positions it examines, are mere ideas in the mind; and not only never did, but never can exist in nature. They never did exist; for no one will pretend to draw a line or make a surface entirely conformable to the definition: They never can exist; for we may produce demonstrations from these very ideas to prove that they are impossible.

But can any thing be imagin'd more absurd and contradictory than this reasoning? Whatever can be conceiv'd by a clear and distinct idea necessarily implies the possibility of existence; and he who pretends to prove the impossibility of its existence by any argument deriv'd from the clear idea, in reality asserts, that we have no clear idea of it, because we have a clear idea. 'Tis in vain to search for a contradiction in any thing that is distinctly conceiv'd by the mind. Did it imply any contradiction, 'tis impossible it cou'd ever be conceiv'd.

There is therefore no medium betwixt allowing at least the possibility of indivisible points, and denying their idea; and 'tis on this latter principle, that the second answer to the foregoing argument is founded. It has been¹ pretended, that tho' it be impossible to conceive a length without any breadth, yet by an abstraction without a separation, we can consider the one without regarding the other; in the same manner as we may think of the length of the way betwixt two towns, and overlook its breadth. The length is inseparable from the breadth both in nature and in our minds; but this excludes not a partial consideration, and a *distinction of reason*, after the manner above explain'd.

In refuting this answer I shall not insist on the argument, which I have already sufficiently explain'd, that if it be impossible for the mind to arrive at a *minimum* in its ideas, its capacity must be infinite, in order to comprehend the infinite number of parts, of which its idea of any extension wou'd be compos'd. I shall here endeavour to find some new absurdities in this reasoning.

A surface terminates a solid; a line terminates a surface; a point terminates a line; but I assert, that if the *ideas* of a point, line or surface were not indivisible, 'tis impossible we shou'd ever conceive these terminations. For let these ideas be suppos'd infinitely divisible; and then let the fancy endeavour to fix itself on the idea of the last surface, line or point; it immediately finds this idea to break into parts; and upon its seizing the last of these parts, it loses its hold by a new division, and so on *in infinitum*, without any possibility of its arriving at a concluding idea. The number of fractions bring it no nearer the last division, than the first idea it form'd. Every particle eludes the grasp by a new fraction, like quicksilver, when we endeavour to seize it. But as in fact there must be something, which terminates the idea of every finite quantity; and as this terminating idea cannot itself consist of parts or inferior ideas; otherwise it wou'd be the last of its parts, which finish'd the idea, and so on; this is a clear proof that the ideas of surfaces, lines and points admit not of any division; those of surfaces in depth; of lines in breadth and depth; and of points in any dimension.

The *schoolmen* were so sensible of the force of this argument, that some of them maintain'd, that nature has mix'd among those particles of matter, which are divisible *in infinitum*, a number of mathematical points, in order to give a termination to bodies; and others eluded the force of this reasoning by a heap of unintelligible cavils and distinctions. Both these adversaries equally yield the victory. A man who hides himself; confesses as evidently the superiority of his enemy, as another, who fairly delivers his arms. Thus it appears, that the definitions of mathematics destroy the pretended demonstrations; and that if we have the idea of indivisible points, lines and surfaces conformable to the definition, their existence is certainly possible: but if we have no such idea, 'tis impossible we can ever conceive the termination of any figure; without which conception there can be no geometrical demonstration.

But I go farther, and maintain, that none of these demonstrations can have sufficient weight to establish such a principle, as this of infinite divisibility; and that because with regard to such minute objects, they are not properly demonstrations, being built on ideas, which are not exact, and maxims, which are not precisely true. When geometry decides any thing concerning the proportions of quantity, we ought not to look for the utmost *precision* and exactness. None of its proofs extend so far. It takes the dimensions and proportions of figures justly; but roughly, and with some liberty. Its errors are never considerable; nor wou'd it err at all, did it not aspire to such an absolute perfection.

I first ask mathematicians, what they mean when they say one line or surface is equal to, or greater, or less than another? Let any of them give an answer, to whatever sect he belongs, and whether he maintains the composition of extension by indivisible points, or by quantities divisible *in infinitum*. This question will embarrass both of them.

There are few or no mathematicians who defend the hypothesis of indivisible points; and yet these have the readiest and justest answer to the present question. They need only reply, that lines or surfaces are equal, when the numbers of points in each are equal; and that as the proportion of the numbers varies, the proportion of the lines and surfaces is also vary'd. But tho' this answer be *just*, as well as obvious; yet I may affirm, that this standard of equality is entirely *useless*, and that it never is from such a comparison we determine objects to be equal or unequal with respect to each other. For as

the points, which enter into the composition of any line or surface, whether perceiv'd by the sight or touch, are so minute and so confounded with each other, that 'tis utterly impossible for the mind to compute their number, such a computation will never afford us a standard, by which we may judge of proportions. No one will ever be able to determine by an exact numeration, that an inch has fewer points than a foot, or a foot fewer than an ell or any greater measure; for which reason we seldom or never consider this as the standard of equality or inequality.

As to those, who imagine, that extension is divisible *in infinitum*, 'tis impossible they can make use of this answer, or fix the equality of any line or surface by a numeration of its component parts. For since, according to their hypothesis, the least as well as greatest figures contain an infinite number of parts; and since infinite numbers, properly speaking, can neither be equal nor unequal with respect to each other; the equality or inequality of any portions of space can never depend on any proportion in the number of their parts. 'Tis true, it may be said, that the inequality of an ell and a yard consists in the different numbers of the feet, of which they are compos'd; and that of a foot and a yard in the number of the inches. But as that quantity we call an inch in the one is suppos'd equal to what we call an inch in the other, and as 'tis impossible for the mind to find this equality by proceeding *in infinitum* with these references to inferior quantities; 'tis evident, that at last we must fix some standard of equality different from an enumeration of the parts.

There are some², who pretend, that equality is best defin'd by *congruity*, and that any two figures are equal, when upon the placing of one upon the other, all their parts correspond to and touch each other. In order to judge of this definition let us consider, that since equality is a relation, it is not, strictly speaking, a property in the figures themselves, but arises merely from the comparison, which the mind makes betwixt them. If it consists, therefore, in this imaginary application and mutual contact of parts, we must at least have a distinct notion of these parts, and must conceive their contact. Now 'tis plain, that in this conception we wou'd run up these parts to the greatest minuteness, which can possibly be conceiv'd; since the contact of large parts wou'd never render the figures equal. But the minutest parts we can conceive are mathematical points; and consequently this standard of equality is the same with that deriv'd from the equality of the number of points; which we have already determin'd to be a just but an useless standard. We must therefore look to some other quarter for a solution of the present difficulty.

'Tis evident, that the eye, or rather the mind is often able at one view to determine the proportions of bodies, and pronounce them equal to, or greater or less than each other, without examining or comparing the number of their minute parts. Such judgments are not only common, but in many cases certain and infallible. When the measure of a yard and that of a foot are presented, the mind can no more question, that the first is longer than the second, than it can doubt of those principles, which are the most clear and self-evident.

There are therefore three proportions, which the mind distinguishes in the general appearance of its objects, and calls by the names of *greater*, *less* and *equal*. But tho' its decisions concerning these proportions be sometimes infallible, they are not always so; nor are our judgments of this kind more exempt from doubt and error, than those on any other subject. We frequently correct our first opinion by a review and reflection; and pronounce those objects to be equal, which at first we esteem'd unequal; and regard an object as less, tho' before it appear'd greater than another. Nor is this the only correction, which these judgments of our senses undergo; but we often discover our error by a juxtaposition of the objects; or where that is impracticable, by the use of some common and invariable measure, which being successively apply'd to each, informs us of their different proportions. And even

this correction is susceptible of a new correction, and of different degrees of exactness, according to the nature of the instrument by which we measure the bodies, and the care which we employ in the comparison.

When therefore the mind is accustom'd to these judgments and their corrections, and finds that the same proportion which makes two figures have in the eye that appearance, which we call *equality*, makes them also correspond to each other, and to any common measure, with which they are compar'd, we form a mix'd notion of equality deriv'd both from the looser and stricter methods of comparison. But we are not content with this. For as sound reason convinces us that there are bodies *vastly* more minute than those, which appear to the senses; and as a false reason wou'd perswade us, that there are bodies *infinitely* more minute; we clearly perceive, that we are not possess'd of any instrument or art of measuring, which can secure us from all error and uncertainty. We are sensible, that the addition or removal of one of these minute parts, is not discernible either in the appearance or measuring; and 'as we imagine, that two figures, which were equal before, cannot be equal after this removal or addition, we therefore suppose some imaginary standard of equality, by which the appearances and measuring are exactly corrected, and the figures reduc'd entirely to that proportion. This standard is plainly imaginary. For as the very idea of equality is that of such a particular appearance corrected by juxta-position or a common measure, the notion of any correction beyond what we have instruments and art to make, is a mere fiction of the mind, and useless as well as incomprehensible. But tho' this standard be only imaginary, the fiction however is very natural; nor is any thing more usual, than for the mind to proceed after this manner with any action, even after the reason has ceas'd, which first determin'd it to begin. This appears very conspicuously with regard to time; where tho' 'tis evident we have no exact method of determining the proportions of parts, not even so exact as in extension, yet the various corrections of our measures, and their different degrees of exactness, have given us an obscure and implicit notion of a perfect and entire equality. The case is the same in many other subjects. A musician finding his ear become every day more delicate, and correcting himself by reflection and attention, proceeds with the same act of the mind, even when the subject fails him, and entertains a notion of a compleat *terce* or *octave*, without being able to tell whence he derives his standard. A painter forms the same fiction with regard to colours. A mechanic with regard to motion. To the one *light* and *shade*; to the other *swift* and *slow* are imagin'd to be capable of an exact comparison and equality beyond the judgments of the senses.

We may apply the same reasoning to curve and right lines. Nothing is more apparent to the senses, than the distinction betwixt a curve and a right line; nor are there any ideas we more easily form than the ideas of these objects. But however easily we may form these ideas, 'tis impossible to produce any definition of them, which will fix the precise boundaries betwixt them. When we draw lines upon paper or any continu'd surface, there is a certain order, by which the lines run along from one point to another, that they may produce the entire impression of a curve or right line; but this order is perfectly unknown, and nothing is observ'd but the united appearance. Thus even upon the system of indivisible points, we can only form a distant notion of some unknown standard to these objects. Upon that of infinite divisibility we cannot go even this length; but are reduc'd meerly to the general appearance, as the rule by which we determine lines to be either curve or right ones. But tho' we can give no perfect definition of these lines, nor produce any very exact method of distinguishing the one from the other; yet this hinders us not from correcting the first appearance by a more accurate consideration, and by a comparison with some rule, of whose rectitude from repeated trials we have a greater assurance. And 'tis from these corrections, and by carrying on the same action of the mind, even when its reason fails us, that we form the loose idea of a perfect standard to these figures, without being able to explain or comprehend it.

'Tis true, mathematicians pretend they give an exact definition of a right line, when they say, *it is the shortest way betwixt two points*. But in the first place I observe, that this is more properly the discovery of one of the properties of a right line, than a just definition of it. For I ask any one, if upon mention of a right line he thinks not' immediately on such a particular appearance, and if 'tis not by accident only that he considers this property? A right line can be comprehended alone; but this definition is unintelligible without a comparison with other lines, which we conceive to be more extended. In common life 'tis establish'd as a maxim, that the straightest way is always the shortest; which wou'd be as absurd as to say, the shortest way is always the shortest, if our idea of a right line was not different from that of the shortest way betwixt two points.

Secondly, I repeat what I have already establish'd, that we have no precise idea of equality and inequality, shorter and longer, more than of a right line or a curve; and consequently that the one can never afford us a perfect standard for the other. An exact idea can never be built on such as are loose and indeterminate.

The idea of a *plain surface* is as little susceptible of a precise standard as that of a right line; nor have we any other means of distinguishing such a surface, than its general appearance. 'Tis in vain, that mathematicians represent a plain surface as produc'd by the flowing of a right line. 'Twill immediately be objected, that our idea of a surface is as independent of this method of forming a surface, as our idea of an ellipse is of that of a cone; that the idea of a right line is no more precise than that of a plain surface; that a right line may flow irregularly, and by that means form a figure quite different from a plane; and that therefore we must suppose it to Bow along two right lines, parallel to each other, and on the same plane; which is a description, that explains a thing by itself, and returns in a circle.

It appears, then, that the ideas which are most essential to geometry, *viz.* those of equality and inequality, of a right line and a plain surface, are far from being exact and determinate, according to our common method of conceiving them. Not only we are incapable of telling, if the case be in any degree doubtful, when such particular figures are equal; when such a line is a right one, and such a surface a plain one; but we can form no idea of that proportion, or of these figures, which is firm and invariable. Our appeal is still to the weak and fallible judgment, which we make from the appearance of the objects, and correct by a compass or common measure; and if we join the supposition of any farther correction, 'tis of such-a-one as is either useless or imaginary. In vain shou'd we have recourse to the common topic, and employ the supposition of a deity, whose omnipotence may enable him to form a perfect geometrical figure, and describe a right line without any curve or inflexion. As the ultimate standard of these figures is deriv'd from nothing but the senses and imagination, 'tis absurd to talk of any perfection beyond what these faculties can judge of; since the true perfection of any thing consists in its conformity to its standard.

Now since these ideas are so loose and uncertain, I wou'd fain ask any mathematician what infallible assurance he has, not only of the more intricate and obscure propositions of his science, but of the most vulgar and obvious principles? How can he prove to me, for instance, that two right lines cannot have one common segment? Or that 'tis impossible to draw more than one right line betwixt any two points? Shou'd he tell me, that these opinions are obviously absurd, and repugnant to our clear ideas; I wou'd answer, that I do not deny, where two right lines incline upon each other with a sensible angle, but 'tis absurd to imagine them to have a common segment. But supposing these two lines to approach at the rate of an inch in twenty leagues, I perceive no absurdity in asserting, that upon their contact they become one. For, I beseech you, by what rule or standard do you judge, when you assert, that the line, in which I have suppos'd them to concur, cannot make the same right line with those two, that form so

small an angle betwixt them? You must surely have some idea of a right line, to which this line does not agree. Do you therefore mean, that it takes not the points in the same order and by the same rule. as is peculiar and essential to a right line? If so, I must inform you, that besides that in judging after this manner you allow, that extension is compos'd of indivisible points (which, perhaps, is more than you intend) besides this, I say, I must inform you, that neither is this the standard from which we form the idea of a right line; nor, if it were, is there any such firmness in our senses or imagination, as to determine when such an order is violated or preserv'd. The original standard of a right line is in reality nothing but a certain general appearance; and 'tis evident right lines may be made to concur with each other, and yet correspond to this standard, tho' corrected by all the means either practicable or imaginable.

This may open our eyes a little, and let us see, that no geometrical demonstration for the infinite divisibility of extension can have so much force as what we naturally attribute to every argument, which is supported by such magnificent pretensions. At the same time we may learn the reason, why geometry fails of evidence in this single point, while all its other reasonings command our fullest assent and approbation. And indeed it seems more requisite to give the reason of this exception, than to shew, that we really must make such an exception, and regard all the mathematical arguments for infinite divisibility as utterly sophistical. For 'tis evident, that as no idea of quantity is infinitely divisible, there cannot be imagin'd a more glaring absurdity, than to endeavour to prove, that quantity itself admits of such a division; and to prove this by means of ideas, which are directly opposite in that particular. And as this absurdity is very glaring in itself, so there is no argument founded on it, which is not attended with a new absurdity, and involves not an evident contradiction.

I might give as instances those arguments for infinite divisibility, which are deriv'd from the *point of contact*. I know there is no mathematician, who will not refuse to be judg'd by the diagrams he describes upon paper, these being loose draughts, as he will tell us, and serving only to convey with greater facility certain ideas, which are the true foundation of all our reasoning. This I am satisfy'd with, and am willing to rest the controversy merely upon these ideas. I desire therefore our mathematician to form, as accurately as possible, the ideas of a circle and a right line; and I then ask, if upon the conception of their contact he can conceive them as touching in a mathematical point, or if he must necessarily imagine them to concur for some space. Whichever side he chuses, he runs himself into equal difficulties. If he affirms, that in tracing these figures in his imagination, he can imagine them to touch only in a point, he allows the possibility of that idea, and consequently of the thing. If he says, that in his conception of the contact of those lines he must make them concur, he thereby acknowledges the fallacy of geometrical demonstrations, when carry'd beyond a certain degree of minuteness; since 'tis certain he has such demonstrations against the concurrence of a circle and a right line; that is, in other words, he can prove an idea, *viz.* that of concurrence, to be *incompatible* with two other ideas, *viz.* those of a circle and right line; tho' at the same time he acknowledges these ideas to be *inseparable*.

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1. *L'Art de penser*.
 2. See Dr. *Barrow's* mathematical lectures.

Section V. The same subject continu'd

If the second part of my system be true, *that the idea of space or extension is nothing but the idea of visible or tangible points distributed in a certain order*, it follows, that we can form no idea of a

vacuum, or space, where there is nothing visible or tangible, This gives rise to three objections, which I shall examine together, because the answer I shall give to one is a consequence of that which I shall make use of for the others.

First, It may be said, that men have disputed for many ages concerning a vacuum and a plenum, without being able to bring the affair to a final decision; and philosophers, even at this day, think themselves at liberty to take party on either side, as their fancy leads them. But whatever foundation there may be for a controversy concerning the things themselves, it may be pretended, that the very dispute is decisive concerning the idea, and that 'tis impossible men cou'd so long reason about a vacuum, and either refute or defend it, without having a notion of what they refuted or defended.

Secondly, If this argument shou'd be contested, the reality or at least possibility of *idea* of a vacuum may be prov'd by the following reasoning. Every idea is possible, which is a necessary and infallible consequence of such as are possible. Now tho' we allow the world to be at present a plenum, we may easily conceive it to be depriv'd of motion; and this idea will certainly be allow'd possible. It must also be allow'd possible, to conceive the annihilation of any part of matter by the omnipotence of the deity, while the other parts remain at rest. For as every idea, that is distinguishable, is separable by the imagination; and as every idea, that is separable by the imagination, may be conceiv'd to be separately existent; 'tis evident, that the existence of one particle of matter, no more implies the existence of another, than a square figure in one body implies a square figure in every one. This being granted, I now demand what results from the commence of these two possible ideas of *rest* and *annihilation*, and what must we conceive to follow upon the annihilation of all the air and subtile matter in the chamber, supposing the walls to remain the same, without any motion or alteration? There are some metaphysicians, who answer, that since matter and extension are the same, the annihilation of one necessarily implies that of the other; and there being now no distance betwixt the walls of the chamber, they touch each other; in the same manner as my hand touches the paper, which is immediately before me. But tho' this answer be very common, I defy these metaphysicians to conceive the matter according to their hypothesis, or imagine the floor and roof, with all the opposite sides of the chamber, to touch each other, while they continue in rest, and preserve the same position. For how can the two walls, that run from south to north, touch each other, while they touch the opposite ends of two walls, that run from east to west? And how can the door and roof ever meet, while they are separated by the four walls, that lie in a contrary position? If you change their position, you suppose a motion. If you conceive any thing betwixt them, you suppose a new creation. But keeping strictly to the two ideas of *rest* and *annihilation*, 'tis evident, that the idea, which results from them, is not that of a contact of parts, but something else; which is concluded to be the idea of a vacuum.

The third objection carries the matter still farther, and not only asserts, that the idea of a vacuum is real and possible, but also necessary and unavoidable. This assertion is founded on the motion we observe in bodies, which, 'tis maintain'd, wou'd be impossible and inconceivable without a vacuum, into which one body must move in order to make way for another. I shall not enlarge upon this objection, because it principally belongs to natural philosophy, which lies without our present sphere. In order to answer these objections, we must take the matter pretty deep, and consider the nature and origin of several ideas, lest we dispute without understanding perfectly the subject of the controversy. 'Tis evident the idea of darkness is no positive idea, but merely the negation of light, or more properly speaking, of colour'd and visible objects. A man, who enjoys his sight, receives no other perception from turning his eyes on every side, when entirely depriv'd of light, than what is common to him with one born blind; and 'tis certain such-a-one has no idea either of light or darkness. The consequence of this is, that 'tis not from the mere removal of visible objects we receive the impression of extension without

matter; and that the idea of utter darkness can never be the same with that of vacuum.

Suppose again a man to be supported in the air, and to be softly convey'd along by some invisible power; 'tis evident he is sensible of nothing, and never receives the idea of extension, nor indeed any idea, from this invariable motion. Even supposing he moves his limbs to and fro, this cannot convey to him that idea. He feels in that case a certain sensation or impression, the parts of which are successive to each other, and may give him the idea of time: But certainly are not dispos'd in such a manner, as is necessary to convey the idea of space or extension.

Since then it appears, that darkness and motion, with the utter removal of every thing visible and tangible, can never give us the idea of extension without matter, or of a vacuum; the next question is, whether they can convey this idea, when mix'd with something visible and tangible?

'Tis commonly allow'd by philosophers, that all bodies, which discover themselves to the eye, appear as if painted on a plain surface, and that their different degrees of remoteness from ourselves are discover'd more by reason than by the senses. When I hold up my hand before me, and spread my fingers, they are separated as perfectly by the blue colour of the firmament, as they cou'd be by any visible object, which I cou'd place betwixt them. In order, therefore, to know whether the sight can convey the impression and idea of a vacuum, we must suppose, that amidst an entire darkness, there are luminous bodies presented to us, whose light discovers only these bodies themselves, without giving us any impression of the surrounding objects.

We must form a parallel supposition concerning the objects of our feeling. 'Tis not proper to suppose a perfect removal of all tangible objects: we must allow something to be perceiv'd by the feeling; and after an interval and motion of the hand or other organ of sensation, another object of the touch to be met with; and upon leaving that, another; and so on, as often as we please. The question is, whether these intervals do not afford us the idea of extension without body?

To begin with the first case; 'tis evident, that when only two luminous bodies appear to the eye, we can perceive, whether they be conjoin'd or separate; whether they be separated by a great or small distance; and if this distance varies, we can perceive its increase or diminution, with the motion of the bodies. But as the distance is not in this case any thing colour'd or visible, it may be thought that there is here a vacuum or pure extension, not only intelligible to the mind, but obvious to the very senses.

This is our natural and most familiar way of thinking; but which we shall learn to correct by a little reflection. We may observe, that when two bodies present themselves, where there was formerly an entire darkness, the only change, that is discoverable, is in the appearance of these two objects, and that all the rest continues to be as before, a perfect negation of light, and of every colour'd or visible object. This is not only true of what may be said to be remote from these bodies, but also of the very distance; which is interpos'd betwixt them; *that* being nothing but darkness, or the negation of light; without parts, without composition, invariable and indivisible. Now since this distance causes no perception different from what a blind man receives from his eyes, or what is convey'd to us in the darkest night, it must partake of the same properties: And as blindness and darkness afford us no ideas of extension, 'tis impossible that the dark and indistinguishable distance betwixt two bodies can ever produce that idea.

The sole difference betwixt an absolute darkness and the appearance of two or more visible luminous objects consists, as I said, in the objects themselves, and in the manner they affect our senses. The angles, which the rays of light flowing from them, form with each other; the motion that is requir'd in the eye, in its passage from one to the other; and the different parts of the organs, which are affected by them; these produce the only perceptions, from which we can judge of the distance. But as these perceptions are each of them simple and indivisible, they can never give us the idea of extension.

We may illustrate this by considering the sense of feeling, and the imaginary distance or interval interpos'd betwixt tangible or solid objects. I suppose two cases, *viz.* that of a man supported in the air, and moving his limbs to and fro, without meeting any thing tangible; and that of a man, who feeling something tangible, leaves it, and after a motion, of which he is sensible, perceives another tangible object; and I then ask, wherein consists the difference betwixt these two cases? No one will make any scruple to affirm, that it consists meerly in the perceiving those objects, and that the sensation, which arises from the motion, is in both cases the same: And as that sensation is not capable of conveying to us an idea of extension, when unaccompany'd with some other perception, it can no more give us that idea, when mix'd with the impressions of tangible objects; since that mixture produces no alteration upon it.

But tho' motion and darkness, either alone, or attended with tangible and visible objects, convey no idea of a vacuum or extension without matter, yet they are the causes why we falsly imagine we can form such an idea. For there is a close relation betwixt that motion and darkness, and a real extension, or composition of visible and tangible objects. First, We may observe, that two visible objects appearing in the midst of utter darkness, affect the senses in the same manner, and form the same angle by the rays, which flow from them, and meet in the eye, as if the distance betwixt them were fill'd with visible objects, that give us a true idea of extension. The sensation of motion is likewise the same, when there is mating tangible interpos'd betwixt two bodies, as when we feel a compounded body, whose different parts are plac'd beyond each other.

Secondly, We find by experience, that two bodies, which are so plac'd as to affect the senses in the same manner with two others, that have a certain extent of visible objects interpos'd betwixt them, are capable of receiving the same extent, without any sensible impulse or penetration, and without any change on that angle, under which they appear to the senses. In like manner, where there is one object, which we cannot feel after another without an interval, and the perceiving of that sensation we call motion in our hand or organ of sensation; experience shews us, that 'tis possible the same object may be felt with the same sensation of motion, along with the interpos'd impression of solid and tangible objects, attending the sensation. That is, in other words, an invisible and intangible distance may be converted into a visible and tangible one, without any change on the distant objects.

Thirdly, We may observe, as another relation betwixt these two kinds of distance, that they have nearly the same effects on every natural phaenomenon. For as all qualities, such as heat, cold, light, attraction, &c. diminish in proportion to the distance; there is but little difference observ'd, whether this distance be mark'd out by compounded and sensible objects, or be known only by the manner, in which the distant objects affect the senses.

Here then are three relations betwixt that distance, which conveys the idea of extension, and that other, which is not fill'd with any colour'd or solid object. The distant objects affect the senses in the same manner, whether separated by the one distance or the other; the second species of distance is found capable of receiving the first; and they both equally diminish the force of every quality.

These relations betwixt the two kinds of distance will afford us an easy reason, why the one has so often been taken for the other, and why we imagine we have an idea of extension without the idea of any object either of the sight or feeling. For we may establish it as a general maxim in this science of human nature, that wherever there is a close relation betwixt two ideas, the mind is very apt to mistake them, and in all its discourses and reasonings to use the one for the other. This phænomenon occurs on so many occasions, and is of such consequence, that I cannot forbear stopping a moment to examine its causes. I shall only premise, that we must distinguish exactly betwixt the phænomenon itself, and the causes, which I shall assign for it; and must not imagine from any uncertainty in the latter, that the former is also uncertain. The phænomenon may be real, tho' my explication be chimerical. The falshood of the one is no consequence of that of the other; tho' at the same time we may observe, that 'tis very natural for us to draw such a consequence; which is an evident instance of that very principle, which I endeavour to explain.

When I receiv'd the relations of *resemblance*, *contiguity* and *causation*, as principles of union among ideas, without examining into their causes, 'twas more in prosecution of my first maxim, that we must in the end rest contented with experience, than for want of something specious and plausible, which I might have display'd on that subject. 'Twou'd have been easy to have made an imaginary dissection of the brain, and have shewn, why upon our conception of any idea, the animal spirits run into all the contiguous traces, and rouze up the other ideas, that are related to it. But tho' I have neglected any advantage, which I might have drawn from this topic in explaining the relations of ideas, I am afraid I must here have recourse to it, in order to account for the mistakes that arise from these relations. I shall therefore observe, that as the mind is endow'd with a power of exciting any idea it pleases; whenever it dispatches the spirits into that region of the brain, in which the idea is plac'd; these spirits always excite the idea, when they run into the proper traces, and rummage that cell, which belongs to the idea. But as their motion is seldom direct, and naturally turns a little to the one side or the other; for this reason the animal spirits, falling into the contiguous traces, present other related ideas in lieu of that, which the mind desir'd at first to survey. This change we are not always sensible of; but continuing still the same train of thought, make use of the related idea, which is presented to us, and employ it in our reasoning, as if it were the same with what we demanded. This is the cause of many mistakes and sophisms in philosophy; as will naturally be imagin'd, and as it wou'd be easy to show, if there was occasion.

Of the three relations above-mention'd that of resemblance is the most fertile source of error; and indeed there are few mistakes in reasoning, which do not borrow largely from that origin. Resembling ideas are not only related together, but the actions of the mind, which we employ in considering them, are so little different, that we are not able to distinguish them. This last circumstance is of great consequence; and we may in general observe, that wherever the actions of the mind in forming any two ideas are the same or resembling, we are very apt to confound these ideas, and take the one for the other. Of this we shall see many instances in the progress of this treatise. But tho' resemblance be the relation, which most readily produces a mistake in ideas, yet the others of causation and contiguity may also concur in the same influence. We might produce the figures of poets and orators, as sufficient proofs of this, were it as usual, as it is reasonable, in metaphysical subjects to draw our arguments from that quarter. But lest metaphysicians shou'd esteem this below their dignity, I shall borrow a proof from an observation, which may be made on most of their own discourses, *viz.* that 'tis usual for men to use words for ideas, and to talk instead of thinking in their reasonings. We use words for ideas, because they are commonly so closely connected, that the mind easily mistakes them. And this likewise is the reason, why we substitute the idea of a distance, which is not considered either as visible or tangible, in the room of extension, which is nothing but a composition of visible or tangible

points dispos'd in a certain order. In causing this mistake there concur both the relations of *causation* and *resemblance*. As the first species of distance is found to be convertible into the second, 'tis in this respect a kind of cause; and the similarity of their manner of affecting the senses, and diminishing every quality, forms the relation of resemblance.

After this chain of reasoning and explication of my principles, I am now prepared to answer all the objections that have been offer'd, whether deriv'd from *metaphysics* or *mechanics*. The frequent disputes concerning a vacuum, or extension without matter, prove not the reality of the idea, upon which the dispute turns; there being nothing more common, than to see men deceive themselves in this particular; especially when by means of any close relation, there is another idea presented, which may be the occasion of their mistake.

We may make almost the same answer to the second objection, deriv'd from the conjunction of the ideas of rest and annihilation. When every thing is annihilated in the chamber, and the walls continue immovable, the chamber must be conceiv'd much in the same manner as at present, when the air that fills it, is not an object of the senses. This annihilation leaves to the *eye*, that fictitious distance, which is discover'd by the different parts of the organ, that are affected, and by the degrees of light and shade; and to the *feeling*, that which consists in a sensation of motion in the hand, or other member of the body. In vain shou'd we search any farther. On whichever side we turn this subject, we shall find that these are the only impressions such an object can produce after the suppos'd annihilation; and it has already been remark'd, that impressions can give rise to no ideas, but to such as resemble them.

Since a body interpos'd betwixt two others may be suppos'd to be annihilated, without producing any change upon such as lie on each hand of it, 'tis easily conceiv'd, how it, may be created anew, and yet produce as little alteration. Now the motion of a body has much the same effect as its creation. The distant bodies are no more affected in the one case, than in the other. This suffices to satisfy the imagination, and proves there is no repugnance in such a motion. Afterwards experience comes in play to persuade us that two bodies, situated in the manner above-describ'd, have really such a capacity of receiving body betwixt them, and that there is no obstacle to the conversion of the invisible and intangible distance into one that is visible and tangible. However natural that conversation may seem, we cannot be sure it is practicable, before we have had experience of it.

Thus I seem to have answer'd the three objections above mention'd; tho' at the same time I am sensible, that few will be satisfy'd with these answers, but will immediately propose new objections and difficulties. 'Twill probably be said, that my reasoning makes nothing to the matter in hand, and that I explain only the manner in which objects affect the senses, without endeavouring to account for their real nature and operations. Tho' there be nothing visible or tangible interpos'd betwixt two bodies, yet we find *by experience*, that the bodies may be plac'd in the same manner, with regard to the eye, and require the same motion of the hand in passing from one to the other, as if divided by something visible and tangible. This invisible and intangible distance is also found *by experience* to contain a capacity of receiving body, or of becoming visible and tangible. Here is the whole of my system; and in no part of it have I endeavour'd to explain the cause, which separates bodies after this manner, and gives them a capacity of receiving others betwixt them, without any impulse or penetration.

I answer this objection, by pleading guilty, and by confessing that my intention never was to penetrate into the nature of bodies, or explain the secret causes of their operations. For besides that this belongs not to my present purpose, I am afraid, that such an enterprize is beyond the reach of human understanding, and that we can never pretend to know body otherwise than by those external

properties, which discover themselves to the senses. As to those who attempt any thing farther, I cannot approve of their ambition, till I see, in some one instance at least, that they have met with success. But at present I content myself with knowing perfectly the manner in which objects affect my senses, and their connections with each other, as far as experience informs me of them. This suffices for the conduct of life; and this also suffices for my philosophy, which pretends only to explain the nature and causes of our perceptions, or impressions and ideas.

I shall conclude this subject of extension with a paradox, which will easily be explain'd from the foregoing reasoning. This paradox is, that if you are pleas'd to give to the invisible and intangible distance, or in other words, to the capacity of becoming visible and tangible distance, the name of a vacuum, extension and matter are the same, and yet there is a vacuum. If you will not give it that name, motion is possible in a plenum, without any impulse *in infinitum*, without returning in a circle, and without penetration. But however we may express ourselves, we must always confess, that we have no idea of any real extension without filling it with sensible objects, and conceiving its parts as visible or tangible.

As to the doctrine, that time is nothing but the manner, in which some real objects exist; we may observe, that 'tis liable to the same objections as the similar doctrine with regard to extension. If it be a sufficient proof that we have the idea of a vacuum, because we dispute and reason concerning it; we must for the same reason have the idea of time without any changeable existence; since there is no subject of dispute more frequent and common. But that we really have no such idea, is certain. For whence shou'd it be deriv'd? Does it arise from an impression of sensation or of reflection? Point it out distinctly to us, that we may know its nature and qualities. But if you cannot point out *any such impression*, you may be certain you are mistaken, when you imagine you have *any such idea*.

But tho' it be impossible to shew the impression, from which the idea of time without a changeable existence is deriv'd; yet we can easily point out those appearances, which make us fancy we have that idea. For we may observe, that there is a continual succession of perceptions in our mind; so that the idea of time being for ever present with us; when we consider a stedfast object at five-a-clock, and regard the same at six; we are apt to apply to it that idea in the same manner as if every moment were distinguish'd by a different position, or an alteration of the object. The first and second appearances of the object, being compar'd with the succession of our perceptions, seem equally remov'd as if the object had really chang'd. To which we may add, what experience shews us, that the object was susceptible of such a number of changes betwixt these appearances; as also that the unchangeable or rather fictitious duration has the same effect upon every quality, by encreasing or diminishing it, as that succession, which is obvious to the senses. From these three relations we are apt to confound our ideas, and imagine we can form the idea of a time and duration, without any change or succession.

Section VI. Of the idea of existence and of external existence

It may not be amiss, before we leave this subject, to explain the ideas of *existence* and of *external existence*; which have their difficulties, as well as the ideas of space and time. By this means we shall be the better prepar'd for the examination of knowledge and probability, when we understand perfectly all those particular ideas, which may enter into our reasoning.

There is no impression nor idea of any kind, of which we have any consciousness or memory, that is not conceiv'd as existent; and 'tis evident, that from this consciousness the most perfect idea and assurance of *being* is deriv'd. From hence we may form a dilemma, the most clear and conclusive that can be imagin'd, *viz.* that since we never remember any idea or impression without attributing existence to it, the idea of existence must either be deriv'd from a distinct impression, conjoin'd with every perception or object of our thought, or must be the very same with the idea of the perception or object.

As this dilemma is an evident consequence of the principle, that every idea arises from a similar impression, so our decision betwixt the propositions of the dilemma is no more doubtful. So far from there being any distinct impression, attending every impression and every idea, that I do not think there are any two distinct impressions, which are inseparably conjoin'd. Tho' certain sensations may at one time be united, we quickly find they admit of a separation, and may be presented apart. And thus, tho' every impression and idea we remember be consider'd as existent, the idea of existence is not deriv'd from any particular impression.

The idea of existence, then, is the very same with the idea of what we conceive to be existent. To reflect on any thing simply, and to reflect on it as existent, are nothing different from each other. That idea, when conjoin'd with the idea of any object, makes no addition to it. Whatever we conceive, we conceive to be existent. Any idea we please to form is the idea of a being; and the idea of a being is any idea we please to form.

Whoever opposes this, must necessarily point out that distinct impression, from which the idea of entity is deriv'd, and must prove, that this impression is inseparable from every perception we believe to be existent. This we may without hesitation conclude to be impossible.

Our foregoing¹ reasoning concerning the *distinction of ideas* without any real *difference* will not here serve us in any stead. That kind of distinction is founded on the different resemblances, which the same simple idea may have to several different ideas. But no object can be presented resembling some object with respect to its existence, and different from others in the same particular; since every object, that is presented, must necessarily be existent.

A like reasoning will account for the idea of *external existence*. We may observe, that 'tis universally allow'd by philosophers, and is besides pretty obvious of itself, that nothing is ever really present with the mind but its perceptions or impressions and ideas, and that external objects become known to us only by those perceptions they occasion. To hate, to love, to think, to feel, to see; all this is nothing but to perceive.

Now since nothing is ever present to the mind but perceptions, and since all ideas are deriv'd from something antecedently present to the mind; it follows, that 'tis impossible for us so much as to conceive or form an idea of any thing specifically different from ideas and impressions. Let us fix our attention out of ourselves as much as possible: Let us chace our imagination to the heavens, or to the utmost limits of the universe; we never really advance a step beyond ourselves, nor can conceive any kind of existence, but those perceptions, which have appear'd in that narrow compass. This is the universe of the imagination, nor have we any idea but what is there produc'd.

The farthest we can go towards a conception of external objects, when suppos'd *specifically* different from our perceptions, is to form a relative idea of them, without pretending to comprehend the related objects. Generally speaking we do not suppose them specifically different; but only attribute to them different relations, connections and durations. But of this more fully hereafter².

1. Part I. sect. 7.
 2. Part IV. sect. 2.
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