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4 Hume’s Theory of Space and Time in its Sceptical Context∗

In *Treatise* 1.2, *Of the ideas of space and time*, Hume examines our ideas of spatial extension and temporal duration, our ideas of geometric equality, straightness, flatness, and mathematical point, and our ideas of a vacuum and of time without change. Hume does not, however, restrict his attention to these ideas; he also draws conclusions about space and time themselves. He argues that space and time are not infinitely divisible, that their smallest parts must be occupied, and that as a consequence there is no vacuum or interval of time without

change. His treatments of matters beyond the scope of the section’s title have received harsh criticism.1 His

conclusions have seemed contrary to mathematics and physics. His method of arguing – applying features of our mere ideas of space and time to space and time themselves – has seemed philosophically inept. The apparent success of these criticisms has led to widespread neglect of this part of Hume’s work.

The neglect is unfortunate. In *Of the ideas of space and time* Hume gives important characterizations of the sceptical approach that will be developed in the rest of the *Treatise*. When that approach is better understood, the force of Hume’s arguments concerning space and time can be appreciated, and the influential criticisms of them can be seen to miss the mark.

Hume’s “system concerning space and time consists of two parts, which are intimately connected together.” First, he concludes that finite portions of space and time are not infinitely divisible, but are composed of a finite number of “simple and indivisible” parts. Second he concludes that these indivisible parts are inconceivable unless occupied by something “real and existent,” and so space and time must each simply be “the manner or order, in which objects exist.” In consequence it is impossible both to conceive of empty space and to conceive of time without anything changing (T 1.2.4.1-2, SBN 39-40).

The arguments composing the first part of Hume’s system are the ones most derided. Not many readers

bother with the second part of his system, since it is, by Hume’s own characterization, a consequence of the first and thus dependent on its success. A new evaluation of Hume on space and time should begin, then, with a new interpretation and defense of his main arguments against infinite divisibility.

1. THE FIRST PART OF HUME’S SYSTEM

*Against Infinite Divisibility*

Hume means to show that not every part of space has parts.2 The argument relies on a claim established in section 1: “that the *idea*, which we form of any finite quantity, is not infinitely divisible.” Ideas for Hume are like images.3 Just as the image in a mirror of a chessboard can be seen to have parts, so any idea of anything that

takes up space will have parts. No idea will have an infinite number of parts, however. This conclusion follows

from two premises. The first is “that the capacity of the mind is limited, and can never attain a full and adequate conception of infinity.” Hume means simply that the mind cannot have an infinite number of ideas. The second premise is “that whatever is capable of being divided *in infinitum*, must consist of an infinite number of parts.” From these two premises it immediately follows that no idea is infinitely divisible. After all, an infinitely divisible idea would have an infinite number of parts and so the mind would have an infinite number of ideas (T 1.2.1.2, SBN 26-7).

The second premise contradicts a long tradition going back to Aristotle who concluded that something

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divisible need not have parts that exist actually, but need only have parts that exist potentially.

However a

rejoinder can be made to the Aristotelians on Hume’s behalf. Some – but not all – of a whole would become its left half, were the whole divided in half. The rest would become the right half. The former is actually on the left

and the latter is actually on the right. They actually differ. Since something can’t differ from itself, they are actually numerically distinct. Since these lesser amounts of the whole are actually distinct from each other, then

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they are actually parts of the whole. So anything divisible actually has the parts it is divisible into.

From the conclusion that no idea is infinitely divisible, Hume concludes that we have some minimal ideas – ideas that cannot be divided. As he says, “’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 diminish’d without a total annihilation.” Likewise there are minimal impressions, where impressions are the vivid images we get in sensory or introspective experiences. Hume describes an experiment to allow one to see a minimal visual impression: “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” (T 1.2.1.3-4, SBN 27). Note that Hume is not saying that the spot of ink is indivisible. With a small telescope one could certainly discern its parts. Rather Hume is talking about the vivid image caused in the mind by the spot of ink. When the spot of ink is close, the image of it in the mind has many parts. As the spot moves further away it causes a smaller image with fewer parts. Just before the spot is too far away to cause any image at all, it causes an image that cannot be further diminished – one with no parts. This last image is indivisible; it is a minimal impression. Minimal ideas are simply less vivid copies of such minimal impressions.

Armed with minimal ideas Hume proceeds in *Treatise* 1.2 to argue confidently that space, or (as he also calls it) “extension,” is not infinitely divisible. More precisely, he argues that no “finite extension,” no portion of space with finite length, is infinitely divisible. The basis for his argument is his claim that minimal ideas are “adequate representations of the most minute parts of extension.” For, he says, “Wherever ideas are adequate representations of objects, the relations, contradictions and agreements of the ideas are all applicable to the objects” (T 1.2.2.1, SBN 29). He is about to argue that because there are smallest, indivisible ideas of the parts of space, there are smallest, indivisible parts of space. The adequacy of the ideas is supposed to justify this

inference.6 What makes them adequate is that “nothing can be more minute” than they are, “since these are ideas

and images perfectly simple and indivisible” (T 1.2.1.5, SBN 28). Being too small to be divided, they are perfect representations of anything too small to be divided.

The argument begins with the assumption used previously, “Every thing capable of being infinitely

divided contains an infinite number of parts” (T 1.2.2.2, SBN 29). So any portion of space, if it is infinitely divisible, has an infinite number of parts. So even a portion of space with finite length, if it is infinitely divisible, has an infinite number of parts. However Hume thinks he can show that any portion of space with an infinite number of parts must have infinite length. It would follow that it is contradictory to talk of an infinitely divisible portion of space with finite length. So there can be no such thing. He uses the minimal ideas from section 1 to explain the contradiction. He forms a minimal idea in his imagination. “I then repeat this idea once. . .” – that is, he imagines a second minimal idea right next to the first. Now he has an idea of the smallest possible extension, the smallest possible length. Note that, because extension has parts, a single minimal idea is not an idea of extension at all (T 1.4.4.8, SBN 228). One must resist the temptation to think that two minimal ideas are twice as long as one. One minimal idea has no length at all; it is simply a single point, whereas something with length must have two distinct endpoints. The two form a length simply because they are at their closest approach while still being distinguishable from each other, which is a fact about the mind not about any bulk the minimal ideas have. So, again, with the first repetition Hume forms the idea of the smallest possible length. Now “I then repeat this idea . . . twice” – that is, he imagines a third minimal idea right next to the second. With the addition of a third minimal idea, the original length doubles. In other words, to the original length composed of the first and second minimal ideas is added an equal length composed of the second and third minimal ideas. On the third repetition of the original idea, that is, the addition of a fourth minimal idea, the original length triples. And so on. Or as Hume put it, “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” (T 1.2.2.2, SBN 29).

From here Hume moves swiftly to his conclusion. He sees that only an idea composed of a finite number of minimal ideas will have finite length. Since the length is proportional to the number of parts, an idea composed of an infinite number of minimal ideas would be infinitely long. Since the minimal ideas are adequate,

what is true of them is true of the smallest parts of extension itself. He concludes “that no finite extension is capable of containing an infinite number of parts; and consequently that no finite extension is infinitely divisible” (T 1.2.2.2, SBN 30).

This conclusion seems to overlook the obvious mathematical possibility that the parts that are added could be proportionately smaller each time. Take the addition of proportionately smaller fractions, for instance 1/2 + 1/4 + 1/8 + 1/16 + 1/32 + . . ., and so on. With each addition the sum approaches 1. No matter how close to 1 you might choose to be, the sum of the whole infinite series is even closer. For this reason the sum of the series has been defined as 1. However 1 is a finite number, nowhere near an infinite number. Similarly, to a part of length 1/2 could be added a non-overlapping part of length 1/4 and then one of length 1/8 and then . . ., and so on, to arrive at a whole of length 1, a decidedly finite length.

Hume considered this objection, but refused to acknowledge its force. In a footnote he says,

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. (T 1.2.2.2 n. 6, SBN 30).

Aliquot parts are of uniform size, whereas proportional parts are of successively smaller size.7 Hume is saying that no parts of extension, proportional or aliquot, will, when added together, yield a length smaller than the length yielded by the addition of the same number of minimal ideas. Why? Because our minimal ideas are “adequate representations of the most minute parts of extension” (T 1.2.2.1, SBN 29). Perhaps everything in space is bigger than these minimal parts, perhaps some things are the same size, but at least nothing can be smaller than they are. One might worry that Hume is assuming that there are most minute parts of extension in order to prove that there are. But he is not. He is only assuming that his minimal ideas are at least as small as any part of extension.

Hume’s proof that finite extension is not infinitely divisible depends crucially, even excruciatingly, on the assumption that our minimal ideas are adequate. On this assumption depends the inference from features of minimal ideas, and features of compounds of them, to features of space or extension itself. It is this assumption,

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however, that seems the least defensible.

Ideas are simply images in the mind that may or may not accurately reflect reality. How can Hume assume with so little argument that in the case of minimal ideas the reflection is accurate? His assumption is especially troubling since the reflection seems so clearly inaccurate, as appears easy to show.

First, distinguish (as Hume does not) between imagining and conceiving. Descartes illustrates the distinction by pointing out that although it is impossible accurately to imagine a chiliagon – a thousand-sided closed plane figure – it is easy to conceive of one. A geometer can even prove some of the properties of such a

figure, for instance that the sum of the interior angles is 179,640 degrees.9 Second, grant that we cannot imagine

something as having an infinity of parts. However surely we can conceive it. We can for instance conceive of a line as a set of dimensionless points as Georg Cantor did.10 Third, grant that we can only imagine the smallest parts of a line being ordered sequentially, one next to another. However we can conceive of different ways

points can be ordered. They might be ordered densely – between any two points is another – as are the rational numbers.11 Or points might even be ordered the way a continuum is, such as the real numbers, where there are even more of them than there are rational numbers.12 Fourth, note that often our best natural science uses mathematics such as geometry or calculus for successful explanation and prediction. This successful use of mathematics presupposes that space is not as we imagine it, but is a continuum the way we conceive it to be. Thus our best science tells us that space is not the way our imaginations represent it. Therefore there is no reason

to accept Hume’s assumption that our minimal ideas are adequate. They are not perfect representations of the

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dimensionless points ordered as a continuum, the way scientists presuppose space to be.

The trouble with this criticism of Hume’s adequacy assumption is that it overlooks the sceptical context of Hume’s treatment of space and time. In that context this criticism, powerful as it is, remains beside the point.

*Hume’s scepticism*

From a modern, narrowly epistemological standpoint, Hume is a Pyrrhonian sceptic who emulates a late Academic sceptic.14 Whether by accident or design, he is a Pyrrhonian more in the way described by Sextus

Empiricus than in the way Hume himself describes. Perhaps Hume’s interpretation of Pyrrhonism was somewhat distorted by the commentators he was familiar with, or perhaps he found it useful just to appeal to a widely extant interpretation.15 In any event, to understand the complexities of Hume’s scepticism, it helps to disregard his own characterizations and to apply the nuanced descriptions of ancient scepticism given by the ancient sources themselves and some exacting commentators of our own day.16 Such descriptions give us some key features to look for in a sceptic’s position which we might otherwise overlook.

The Pyrrhonians distinguished two kinds of assent – (i) active endorsement of a view as true based on an appropriate reason, and (ii) passive acquiescence in a view forced upon one by appearances. In seeking after truth they found that any reasons for endorsing a view as true could be counterbalanced by reasons for not so endorsing it. They found themselves suspended, unable to endorse any view or the opposite of any view. This suspension of judgment was not, contrary to the contentions of Hume and many of his predecessors, supposed to be a suspension of all assent whatsoever. The Pyrrhonians, while continuing to seek the truth about reality, allowed themselves to acquiesce in whatever view happened to be forced upon them by the appearances of things. If they appeared to be at the edge of a cliff in danger of falling, they would try not to fall. They would do so, however, without endorsing as true the views that were motivating them.

The late Academics were a bit more dogmatic than the Pyrrhonians. They found that they retained certain beliefs after weighing the conflicting arguments, and regarded this fact as evidence that some beliefs were more likely true – more probable – than others. Thus they found it plausible that truth could at least be

approached.17

The Pyrrhonians undercut philosophy, science, and mathematics. The late Academics, with their reliance

on probable beliefs, provided for these endeavors. Hume admired the modern flowering of such an approach in

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Newton.

However the Academics in their degree of dogmatism were still vulnerable to a Pyrrhonian-type

challenge. Hume gives it in *Of scepticism with regard to reason*, where he critiques an Academic reliance on the probable. He argues in effect that the Academic cannot justify any degree of belief in any conclusion (T 1.4.1,

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SBN 180-7). However, Hume invents a Pyrrhonian facsimile of Academic probability, as follows.

Like the Pyrrhonians, Hume finds no final reason actively to endorse any views as true, or even as probable. He is content passively to acquiesce in whatever views are forced on him by appearances. He says, “After the most accurate and exact of my reasonings, I can give no reason why I shou’d assent to it; and feel nothing but a *strong* propensity to consider objects *strongly* in that view, under which they appear to me” (T 1.4.7.3; SBN 265). His main innovation is to make distinctions between the relative strength or weakness of the forcing. It is by feeling that the mind distinguishes the degree to which an idea is forced upon it: “An idea assented to *feels* different from a fictitious idea, that the fancy alone presents to us: And this different feeling I endeavour to explain by calling it a superior *force*, or *vivacity*, or *solidity*, or *firmness*, or *steadiness*” (T 1.3.7.7, SBN 629). Because they concern feeling, the distinctions Hume makes are like aesthetic distinctions: “’Tis not solely in poetry and music, we must follow our taste and sentiment, but likewise in philosophy. When I am convinc’d of any principle, ’tis only an idea, which strikes more strongly upon me. When I give the preference to one set of arguments above another, I do nothing but decide from my feeling concerning the superiority of their influence” (T 1.3.8.12, SBN

103).20 Sometimes ideas are imposed on us by principles of reasoning that are “changeable, weak, and

irregular.” Their influence can be undercut by a due contrast with ideas imposed on us by principles that are “permanent, irresistible, and universal” (T 1.4.4.1, SBN 225). In this way “we might hope to establish a system or set of opinions, which if not true (for that, perhaps, is too much to be hop’d for) might at least be satisfactory to the human mind, and might stand the test of the most critical examination” (T 1.4.7.14, SBN 272). Thus Hume is able to distinguish between, on the one hand, views that would remain stable through time and from place to place, and, on the other hand, views that would vary by time or place. The latter would include

superstitions, myths, the fictions of the ancient philosophers. Some of our stable views will be fundamental common sense beliefs, such as those in the unitary self and the external world, but there is also room for views in philosophy, science, and mathematics. And so Hume makes room for “refin’d reasoning” and “the most elaborate philosophical researches” in his sceptical approach.21 Like a critic in the arts who tries to distinguish classic works from passing fancies, Hume tries to distinguish the most stable of the views forced upon us by

appearances. He extends the Pyrrhonian approach beyond active daily life into theoretical matters. Thus Hume is a Pyrrhonian sceptic whose discrimination concerning the force and stability of passive acquiescence in views gives him a procedure for doing philosophy, science, and mathematics with results akin to those of the later Academic sceptics and their modern heirs. The difference is that Hume makes no connection between the degree to which a view is forced upon him and the degree to which it is likely to be true.

Much success in arriving at stability is to be hoped for when our views concern sensory appearances of objects. There are views provoked by other sorts of appearances, but few as stable “As long as we confine our speculations to the *appearances* of objects to our senses, without entering into disquisitions concerning their real natures and operations, we are safe from all difficulties, and can never be embarrass’d by any question” (T

1.2.5.26 n. 12, SBN 638). Note the appeal to objects as they appear to the senses. Hume’s scepticism explains his empiricism. That is, his assent only to views forced on him by appearances explains his reliance on experience. He says that “we can never pretend to know body otherwise than by those external properties, which discover themselves to the senses.” Extension and duration will turn out to be two such properties. When discussing them he contents himself “with knowing perfectly the manner in which objects affect my senses, and their connexions with each other, as far as experience informs me of them” (T 1.2.5.26, SBN 64). This approach is the one he promises in introducing his “science of man.” Thus he says that “the only solid foundation” for his theory of human nature “must be laid on experience and observation” (T Intro 7, SBN xvi). This empiricism which he learned from Boyle, perhaps Newton, and others, Hume takes simply to be an aspect of his Pyrrhonism:

And tho’ we must endeavour to render all our principles as universal as possible, by tracing up our experiments to the utmost, and explaining all effects from the simplest and fewest causes, ’tis still certain we cannot go beyond experience; and any hypothesis, that pretends to discover the ultimate original qualities of human nature, ought at first to be rejected as presumptuous and chimerical. (T Intro 8. SBN xvii)

As with the study of human nature, so with all sciences. “None of them can go beyond experience, or establish any principles which are not founded on that authority” (T Intro 10, SBN xviii). Hume’s Pyrrhonian Empiricism

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is thus concerned only with objects as they appear to us in experience.

Some incautious uses of the words ‘real’ and ‘really’ might be thought to belie this claim.23 When characterizing his scepticism Hume contrasts the appearances of objects with their unknowable real natures, as one would expect. However, once he takes it to be understood that he is confining his attention to these appearances, he sometimes feels free to reapply the contrast between appearance and reality. In effect he is then distinguishing how an object really appears from how it apparently appears – a contrast allowed by his distinction between more stable and less stable views of things. At other times he contrasts being real with being a non-entity, or, in other words, with being something that appears as opposed to being nothing. Sometimes he uses ‘in reality’ to distinguish a view forced on the mind from the view being criticized. Sometimes he contrasts being real with being only in the mind, though again this contrast is within the world as it appears. Such uses of ‘real’ “imply no dogmatical spirit” any more than phrases such as “*’tis evident, ’tis certain, ’tis undeniable*.” The propensity to use such expressions is, as Hume says, “so natural” that they were “extorted from me by the present view of the object” (T 1.4.7.15, SBN 273-4). But despite such expressions, he is still confining his attention to objects as they appear to us in experience.

One of Hume’s innovations was to find out about objects as they appear to us by examination of the ideas we use to represent them. For instance he comes to the conclusion that a mathematical point must have color or solidity in order to be an entity that can “by its conjunction with others form a real existence” (T 1.2.4.3,

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SBN 40).

In the course of this investigation he asks, “*What is our idea of a simple and indivisible point?*” and

comments, “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” (T 1.2.3.14, SBN 38). Examining our ideas can help in finding out how objects appear to us. When our ideas are obscure, we can settle controversies about them by examining the impressions from which the parts of the ideas are copied (T 1.2.3.1, SBN 33). Hume’s famous copy principle – that all simple ideas are copied from impressions – is part of his sceptical view that the ultimate source of all our views is appearances (see T 1.1.1.7, SBN 4).

As Pyrrhonian, Hume does not even actively endorse the philosophical framework he uses to characterize his sceptical approach. That there are external physical objects (what Hume calls in general “body”) is not something Hume finds any justification to believe. It is a belief forced on us. As he says, “’tis in vain to ask, *Whether there be body or not?* That is a point, which we must take for granted in all our reasonings” (T 1.4.2.1, SBN 187). Further, that there is an internal world of perceptions caused by the external world of objects is a belief philosophers find themselves with when they reflect on experience. This belief lacks justification as well, yet it is durable. One might focus on passages in which Hume is questioning this philosophical framework, or is thinking along the lines of ordinary non-philosophical people, to conclude that by talk about the external world he means to be talking about our impressions of it. But when doing philosophy one cannot shake the

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framework for long (T 1.4.2.41-57, SBN 208-18).

When Hume is operating within it, he means really to be

talking about the external world as it is experienced via our impressions and as it is represented by our most stable ideas. This framework may seem for a moment to be less justified than the conclusion that there are only perceptions, but the framework is actually more stable.

We might be misled by Hume’s claim that his philosophy “pretends only to explain the nature and causes of our perceptions, or impressions and ideas” (T 1.2.5.26, SBN 64). We are more easily misled if we confuse objects as they appear with the impressions they occasion. Certainly Hume devotes attention and care to characterizing our perceptions. But the context of the above remark is a paragraph in which Hume is contrasting

what he is *not* trying to do – “penetrate into the nature of bodies” – with what he *is* trying to do – to “know body…by those external properties, which discover themselves to the senses.” Part of the task in examining perceptions is to discover the properties of the objects of those perceptions, that is, objects as they appear to us. In other words, as Pyrrhonian, he is concerned to characterize the external world by those appearances that force views upon us.

*The sceptical context of Hume’s argument*

Hume’s assumption that our minimal spatial ideas are adequate representations of the least part of extension falls out of this sceptical approach. Our ideas of the external world are images of the world as it appears to us. Being copied from sense impressions, their characteristics are determined by the way external objects “discover themselves to the senses” (T 1.2.5.26, SBN 64). Not all complex ideas are faithful to the world as it appears because of “*the liberty of the imagination to transpose and change its ideas*” (T 1.1.3.4, SBN 10). By rearrangement of their parts we can invent new complex ideas differing from any complex impressions we have had. But simple ideas are completely forced upon us. They give us the elements of the world as it appears. They are adequate representations of these elements. And so our minimal spatial ideas are adequate representations of the least part of extension as it appears. If they can only be ordered sequentially, one next to the other, then the same holds of extension as it appears. If no extended idea of finite length can contain an infinite number of adequate minimal ideas, then no extension as it appears can contain an infinite number of parts.

Talk by Hume’s critics of infinitely divisible space as a set of points ordered as a continuum would for him amount merely to empty words. Given the copy principle, since there could be no impression of such a set with its elements ordered in such a way, there could be no idea of it. Beyond that, this conceit of a mathematical continuum is not forced upon us by appearances and there is no way to know if it is true of reality.26 If we try to apply it to the world as it appears, we end up in contradiction. Not only is assent to the conceit not forced,

dissent from it *is* forced: “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 [*as it appears to the senses*] admits of such a division; and to prove this by means of ideas, which are directly opposite in that particular” (T 1.2.4.32, SBN 52). I have added the phrase ‘*as it appears to the senses*’ as a reminder of the sceptical context of all such inferences from idea to object. The phrase helps bring out the force of Hume’s remark just quoted: one cannot use ideas that are adequate representations of quantity as it appears, in order to prove that quantity as it appears is different than it appears. Hume’s incautious use of the phrases “really impossible and contradictory” and “real quality of extension” in the argument at 1.2.2.1-2, SBN 29 must not mislead us about Hume’s scepticism. He is merely expressing the views forced on him by appearances, whatever incautious expressions

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happen to be extorted from him.

If one is still dubious about Hume’s appeal to ideas to prove his point, then one should return to impressions. Look at grains of sand from the furthest distance at which they are still visible, perhaps arm’s length.28 Move them around with a needle. Ones too close together cannot be distinguished from a single one.

Pairs that can be distinguished from a single grain form a tiny extension. The apparent length of the extension grows with the number discernibly added, just as Hume says. The length is proportional to the number discernibly added, just as Hume says. It is of no use to look more closely to see how the grains are really arranged and if there is really any space between them or if they really touch. The grains are not the concern; of concern are only the impressions caused by them at the maximum distance at which the grains are visible. From

these impressions the conclusion is forced upon one that an extension of merely finite length cannot be built up from an infinite number of such parts. 29 It seems obvious that space as it appears is not infinitely divisible.

As with space, so with time, Hume thinks. He adds one argument peculiar to time that, again, is best understood as an argument concerning time as it appears. In our experience, all moments occur successively, one immediately after the other. So they exist one at a time in the present. So only the present moment exists. Thus if the present moment were divisible into further moments its parts would each be present. So they would coexist.

But since all moments are successive, no moments coexist. So if all moments were divisible into further moments, the present moment would be as well, so its parts would be coexisting moments that do not coexist – an “arrant contradiction” (T 1.2.2.4, SBN 31).

Hume’s Pyrrhonian Empiricism is presupposed by his main arguments concerning space and time. All his conclusions about space and time should be read as claims about space and time *as they appear*. If one is going to disagree with Hume on infinite divisibility, then one is going to have to take issue with his Pyrrhonian Empiricism by showing, for example, that knowledge is possible, or that there is another way to be a sceptic than by acquiescing to views forced on one by appearances, or by showing that the appearances of the external world are not always so closely tied to what is conveyed by the senses. One cannot, however, simply accuse Hume of ineptly reasoning from idea to reality or of making mathematical blunders. Such accusations overlook his sceptical approach to issues concerning space and time, and are irrelevant to judging its success.

*The general argument against geometric proofs of infinite divisibility*

Hume gives various other arguments that space has indivisible parts, that is, parts without parts.30 He supports these with a crucial general argument against any supposed geometric proof of the infinite divisibility of space. Hume argues that no such proof can succeed (T 1.2.4.17-31, SBN 44-52, 638). He does so “by denying geometry to be a science exact enough to admit of conclusions so subtile [subtle] as those which regard infinite divisibility” (A 29, SBN 658). The importance he gives to this argument is evidenced by its mention in the Abstract – a piece written to promote the *Treatise*. Besides the long summary of his views on causation and causal inference, the only other highlights of Book 1 of the *Treatise* mentioned there are his bundle theory of the self and his general argument against geometric proofs of infinite divisibility.

All such proofs pretend to be demonstrations based on precise definitions and exceptionless geometric axioms. Hume argues to the contrary that “they are not properly demonstrations, being built on ideas that are not exact, and maxims, which are not precisely true.” The principles of geometry do not apply beyond a certain level

of precision and certainly not to “such minute objects” as are envisioned by the defenders of infinite divisibility (T 1.2.4.17, SBN 45).

Hume takes for granted that what is at issue is the status of geometry as it applies to the space which we explore by means of our senses. Given the copy principle, a pure geometrical space would not be something of which we could have ideas. But beyond that, as before, the conceit of pure geometrical space is not forced upon us by appearances and there is no way to know if it is true of reality beyond appearances.

Geometry is inexact, Hume says, because the ultimate standard of equality for geometric figures, for straightness for lines, and for flatness of planes is merely appearance to the senses or the imagination. Thus our ideas of these geometric properties are merely ideas of appearing equal, appearing straight, and appearing flat. Thinking that there is a more exact, yet still useful, standard than mere appearance is a natural fiction, but a fiction nonetheless. For what could that standard be? Hume shows that nothing besides appearance will do.

Consider equality. Hume’s own theory affords a precise standard of equality. Two figures are equal “when the numbers of points in each are equal.” However this proposed standard is useless because we cannot discern the indivisible parts of things outside the mind. They are too small, or as Hume says, “so minute and so confounded with each other, that ’tis utterly impossible for the mind to compute their number.” Further this proposed standard is not available to those Hume is arguing against, viz., those who contend that every part has parts, “since, according to their hypothesis, the least as well as greatest figures contain an infinite number of parts” (T 1.2.4.19-20, SBN 45-6). The only other alternative is that the standard of equality for two figures is simply their appearing equal. Actually, first appearances can sometimes be misleading. We’ve learned to correct them by determining whether the figures continue to appear equal even after they have been juxtaposed or compared in size to some movable third figure (the “common measure”). The result, as Hume puts it, is that “the very idea of equality is that of such a particular appearance corrected by juxta-position or a common measure” (T 1.2.4.24, SBN 48). Thus the notion of equality in geometry is based on this standard determined by appearance.

We are well aware that the standard is not exact. Addition or removal of a single minute part would

make no difference to equality according to this standard, since it would be “not discernible either in the appearance or measuring.” Yet we imagine that such action renders equals unequal, so we “suppose some imaginary standard of equality, by which the appearances and measuring are exactly corrected.” The relatively crude process of correction we are capable of impels the mind to continue, by a kind of inertia, to imagine that there is the possibility of correction beyond that of which we are capable. We imagine there to be facts about how things would appear – things too small to make any difference to any possible appearance – if only the right conditions enabled us to discern them. But this standard of equality is “a mere fiction of the mind, and useless as well as incomprehensible,” Hume says. There is no reason to believe that what cannot appear would appear a

certain way in certain conditions. Since our notion of equality is derived only from appearance, there is no applying it beyond possible appearance. Thus appearance (or at least appearance corrected by juxtaposition or

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use of a common measure) is our best, though inexact, standard of equality (T 1.2.4.24, SBN 48).

We have only the same sort of standard for straightness. “Nothing is more apparent to the senses, than the distinction betwixt a curve and a right [straight] line.” However we cannot define either in terms of how their tiniest parts are arranged, because “this order is perfectly unknown, and nothing is observ’d but the united appearance.” Geometers may try to define a straight line as the “*shortest way betwixt two points*,” but this overlooks the fact that the connection between straightness and shortness is a discovery, not something true by

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definition (T 1.2.4.25-6, SBN 49-50).

The situation is the same for flatness. “The idea of a *plane 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.” Geometers may try to define a plane as what is “produc’d by the flowing of a right line,” but that would work only if the line flowed along a plane, so the definition in order to be true would have to be circular (T 1.2.4.28, SBN 50).

Analogous to the case of the equality of geometric figures, we realize that there could be curvings of an apparently straight line or warpings of an apparently flat plane that are not noticed at first but which can be

detected by juxtaposition or use of a common measure. And analogously our practices of correcting initial appearances leads us to “form the loose idea of a perfect standard to these figures, without being able to explain or comprehend it” (T 1.2.4.25, SBN 49).

Hume concludes that for cases in which it is “in any degree doubtful” whether figures are equal or not, whether a line is straight or not, and whether a plane is flat or not, there is no standard that determines which of the options is in fact true. The ideas “most essential to geometry” are not “exact and determinate.” That is, again, because the only standard for the application of these ideas is “the weak and fallible judgment, which we make from the appearance of the objects, and correct by a compass or common measure” (T 1.2.4.29, SBN 50-1).

Hume continues: “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?” For example suppose two lines have a line segment in common. If they form an obvious angle with each other, it is clear that at least one of the lines is not straight. At least one of them must bend or curve in order for the lines to overlap for a bit. But what if the angle is very, very small? What if the lines “approach at the rate of an inch in twenty leagues?” Even if they “become one” at some point, they will give every appearance of being straight. There is no further “rule or standard” which makes it true of either line that it is not straight. Thus the seemingly obvious assumption of Euclid’s geometry that distinct straight lines cannot share a common segment fails in such a case, because there is no more to being straight than giving every appearance of being straight: “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

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standard, tho’ corrected by all the means either practicable or imaginable” (T 1.2.4.30, SBN 51).

Thus geometrical axioms are liable to fail in cases in which their success would require differences too subtle to make a difference to appearance. Reliable application of our geometric principles is restricted to clear appearances.34 This restriction entails that it is illegitimate to apply these principles to figures too small to yield

any possible appearance. Yet such illegitimate application is what the geometers do in their proofs of infinite

divisibility:

if they employ, as is usual, the inaccurate standard, deriv’d from a comparison of objects, upon their general appearance, corrected by measuring and juxta-position; their first principles, tho’ certain and infallible, are too coarse to afford any such subtile inferences as they commonly draw from them. The first principles are founded on the imagination and senses: The conclusion, therefore, can never go beyond, much less contradict these faculties. (T 1.2.4.31, SBN 638)

The general proof against arguments for infinite divisibility explains the caution against applying geometrical principles beyond clear appearance. The caution against contradicting appearance harks back to Hume’s initial argument that our idea of extension consists of indivisible parts. Thus mathematicians who argue that every part of extension has parts not only illegitimately go beyond appearance, they actually contradict it. However it is absurd to try to use ideas that copy appearance in order to prove that appearance differs from these ideas (T 1.2.4.32, SBN 52).

Hume gives an example of the failure of trying to use ideas derived from experience to go beyond and contradict experience. He considers the class of arguments that every part of extension has parts “deriv’d from the *point of contact*” (T 1.2.4.33, SBN 53). Hume gives more detail about such arguments in the first *Enquiry*. For example, consider a circle and a straight line tangent to it. For any angle formed by two straight lines, no matter how small, the “angle of contact” between a circle and its tangent is less (EHU 12.18, SBN 157). Think of the angle formed by the tangent and some chord from the point of tangency. No matter how small the angle, the space between the two lines is divided by the arc of the circle. Thus, Hume’s opponents argue, for every portion of space there is a smaller portion.

Far from helping his opponents, however, the circle and tangent example brings up a dilemma they cannot escape. So Hume argues. Consider the point of tangency. If it is an indivisible part then Hume’s opponents are wrong that every part has parts. If the point of tangency is a part with parts then a straight line and a curved line coincide for a distance, which establishes that at a certain level of minuteness there is no standard

for distinguishing a straight line from a curved one. “Which-ever side he chooses, he runs himself into equal

difficulties” (T 1.2.4.33, SBN 53). Proponents of infinite divisibility must either accept indivisible points or

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must accept his general argument against their supposed geometric proofs of their position.

The general argument supports his conclusion that there are indivisible parts of extension. In addition, showing the ideas “most essential to geometry” to be derived simply from appearance is part of Hume’s skeptical view that in doing geometry we are simply acquiescing in views forced on us by appearances.

1. THE SECOND PART OF HUME’S SYSTEM

*Colored or Tangible Points*

The first portion of Hume’s system concerning space and time concludes that they are not infinitely divisible, but consist of indivisible parts. In the second portion he concludes that these parts are inconceivable unless

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occupied by something real, and so space and time must simply be manners in which real things are arranged.

In consequence it is impossible both to conceive of empty space and of time without anything changing (T 1.2.4.1-2, SBN 39-40).

Here Hume might seem to be opposing the view endorsed by Newton that space and time are absolute in the sense of existing independently of the things that occupy them.37 However Hume’s approach is subtler than mere opposition. Newton contended that space as it really is, is absolute; space as it appears is relative to

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perceived objects.

I do not define time, space, place, and motion, as being well known to all. Only I must observe, that the common people conceive those quantities under no other notions but from the relation they bear to sensible objects.

….

II. Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of the absolute spaces; which our senses determine by

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its position to bodies. . . .

Hume follows this lead. As sceptic he suspends endorsement of Newton’s first contention that space as it really is, is absolute, while acquiescing in the second that space as it appears is relative to perceived objects.

The thinker whose views Hume had most prominently in mind, however, was Bayle. Hume’s system as a whole was most likely written as a response to the general problem Bayle posed for the divisibility of space and time: “Extension cannot be made up of either mathematical points, atoms, or particles that are divisible to infinity; therefore its existence is impossible.”40 In other words, there are only three candidates for the parts of space – unextended indivisible parts (what Bayle and Hume both call “mathematical points” and sometimes

Hume calls “atoms”), extended, indivisible parts (what Bayle calls “atoms” and what Hume calls “physical points”), and extended, divisible parts (thus infinitely divisible parts since every part, being divisible, would

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itself have parts).

Bayle gives arguments against each alternative. He intends to show that reason cannot make

sense of the composition of extension. As a fideist, his overall goal is to humble reason so it will not presume to challenge religious faith.

Bayle gives several arguments against infinitely divisible parts. However he thinks the absurdity of the view is “as clear and evident as the sun” to the unprejudiced: “An infinite number of parts of extension, each of which is extended and distinct from all the others, both with regard to its being and to the place that it occupies,

cannot be contained in a space one hundred million times smaller than the hundredth thousandth part of a grain of barley.”42 Hume agrees, of course, and has his own arguments in support of the absurdity of infinite divisibility. Bayle’s argument against physical points is as follows: Anything extended has distinct parts, for

instance a left half and a right half. Having distinct parts entails being divisible in the relevant sense of ‘divisible’. So there cannot be extended, indivisible points. Hume agrees with this argument as well, noting that the “system of *physical* points . . . is too absurd to need a refutation” (T 1.2.4.3, SBN 40).

Bayle’s argument against mathematical points derives from Zeno’s paradox of extension. Mathematical

points are unextended. Thus they have zero length. Adding parts of zero length together yields a whole of zero length no matter how many parts are involved. So no finite interval can be composed of mathematical points. As Hume puts Bayle’s argument, “a mathematical point is a non-entity, and consequently can never by its

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conjunction with others form a real existence” (T 1.2.4.3, SBN 40).

Here Hume disagrees. We do have, after all, an idea of extension as consisting of a conjunction of unextended, indivisible points – the very idea appealed to in Hume’s first argument against infinite divisibility. Since we have the idea, extension composed that way must be possible. As Hume says, “’Tis an establish’d maxim in metaphysics . . . *that nothing we imagine is absolutely impossible*” (T 1.2.2.8, SBN 32). The extent to which a skeptic is entitled to use established maxims in metaphysics might be debatable, but in this case Hume’s reliance on appearance leaves little room for debate. As my sand experiment shows, the idea Hume appeals to can be directly copied from an impression of extension. So we can be sure that extension as it appears can conform to the idea.

Bayle goes wrong by assuming that there is no way to conjoin parts of no length to form a whole of some length.44 To find a way, Hume thinks, we merely have to use our imaginations. Alternatively we could use the sand experiment. The key is that we do not try to conceive how things are in some pure conceptual space.

We stick with appearance. That amounts to “bestowing a colour or solidity on these points,” in other words, it amounts to imagining or sensing them to be occupied by things detectable by sight or touch (T 1.2.4.3, SBN 40). Bayle was right concerning *un*occupied mathematical points that they are no better than non-entities and cannot be conjoined to form an entity. Such points are “inconceivable when not fill’d with something real and existent” (T 1.2.4.2, SBN 39). But filled ones avoid Bayle’s conclusion.

’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. (T 1.2.3.15, SBN 38-9)

One might object that color and tangibility do not help. The indivisible points must have edges that either touch or not, and they must have shape. If they have edges or shape then they must have differentiable parts and so can be further sub-divided, after all. Further, if they touch, they must totally penetrate each other, since they would have no parts that do not touch. (T 1.2.4.4, SBN 40-1) Alternatively, if they do not touch then there is more to space than Hume’s points. Such objections seem forceful, but misunderstand Hume’s concern with appearance. The impression received from a barely visible grain of sand accurately reflects a colored or tangible mathematical point. That impression has no edges, no shape. It can “touch” another impression, but only in the sense of there being no indivisible impression between them – a sense that neither entails penetration

nor there being something else between them.45 To understand Hume, we must not make the mistake of thinking

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that such impressions have geometric characteristics at a level below our ability to discern them.

It is not just the points that must be conceived as colored or tangible. As Hume says, “Now as the parts are, such is the whole.” We can only conceive of extension by conceiving of its parts and we can only conceive of them by conceiving of them as colored 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” (T 1.2.3.16, SBN 39).

*Manners in which objects exist*

The idea of space is the idea of a whole composed of indivisible parts. It is an “*abstract* or *general*” idea, however, not a “*particular*” idea. (T 1.1.7.1, SBN 17; T 1.2.3.5, SBN 34) In other words, the idea of space is not an idea of a particular vast container or dimension, as one might commonly suppose. Rather, in accordance with Hume’s theory of abstract or general ideas, the idea of space is an idea of some arbitrary extended whole, such as a tabletop or a wall, with an eye to the way it resembles other extended wholes. The way extended wholes resemble is specifically the manner in which their indivisible parts are arranged. Thus ‘space’ is synonymous

with ‘extension’ for Hume, in the sense of ‘extendedness.’

Hume’s view belongs to a family of views about space termed “relational” or “relationist.” Contrasting views are termed “absolute” (in the sense given above) or “substantival.” In a famous correspondence, Leibniz

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defended a relational view against the absolute view of the Newtonian, Samuel Clarke.

The basis of Hume’s

relational view of space is his reliance on the copy principle, the principle “*that all our simple ideas in their first appearance are deriv’d from simple impressions, which are correspondent to them, and which they exactly represent*” (T 1.1.1.7, SBN 4). Note that Hume’s skepticism, his exclusive concern with appearances, helps motivate the copy principle. An idea of space concerns space as it appears to our senses, or in other words, as it appears in our sense impressions. Not only does the copy principle help codify his reliance on how things appear in our experience, it gives him a method of making ideas clear. “No discovery cou’d have been made more happily for deciding all controversies concerning ideas, than that above-mention’d,” viz., the copy principle. Our ideas are often “obscure” but our impressions “are all so clear and evident, that they admit of no controversy” (T 1.2.3.1, SBN 33).

The idea of space must be derived in some way from some of our impressions. It cannot be derived from “internal impressions” – “our passions, emotions, desires and aversions” (T 1.2.3.3, SBN 33). Such feelings are not spatial. They cannot be conjoined to form something that takes up space (T 1.4.5.9, SBN 235). So the idea must come from impressions conveyed by the senses. The relevant impressions are sensory impressions of things in space, such as a tabletop. “But my senses convey to me only the impressions of colour’d points, disposed in a certain manner.” It follows “that the idea of extension is nothing but a copy of these colour’d

points, and of the manner of their appearance” (T 1.2.3.4, SBN 34).48

Without the preparation afforded by the ink spot experiment and without a consideration and rejection of infinite divisibility (especially in the light of the answer to Bayle’s challenge), we readers of Hume might easily have overlooked the colored points in our experience. After all, because each is so small and is right next to its nearest neighbor, we too easily run together such points in perception (T 1.2.4.19, SBN 45). However, given that

preparation, Hume’s characterization is a natural one. When we perceive a table we perceive an expanse with parts we can distinguish even if they are seamlessly connected. Such parts have discernible parts, which themselves have discernible parts, and so on, down to the level of indivisible, partless parts. These last are hard to distinguish precisely, but with the suitable preparation we cannot help but believe they are there. 49

Thus seeing a tabletop gives us an impression, and so an idea, of colored points, perhaps “of a purple

colour,” arranged in a certain manner. Seeing expanses of other colors, “violet, green, red, white, black, and of all the different compositions of these,” gives us the idea of different colored points with similar arrangement. Merely feeling expanses such as marble floors, pillows, oven doors, and so on, that are hard or soft, hot or cold, gives us further ideas of points, tangible ones without color yet with a similar arrangement. It is by noticing the similar manner of being arranged that we get the idea of space (T 1.2.3.5, SBN 34).

Here Hume appeals to his account of “abstract” ideas, better thought of as *general* ideas. An abstract idea is an idea of some characteristic, some respect in which particular things resemble. For instance, the abstract idea of color would be an idea of the respect of resemblance between colored things; that of green would be an idea of the respect of resemblance between green things. We cannot have an idea of a respect of resemblance without thinking of the things that resemble, according to Hume. We cannot think separately of redness, say; we can only think generally of red things. So we come to have abstract ideas as follows: An idea of a particular thing naturally brings to mind ideas of particulars which resemble it in a certain way. For example, an idea of a tulip may remind one of a similarly colored rose. Which respect of resemblance is in play at a given time is at first arbitrary and inexplicable. But after a while some such associations become habitual and we, by another inexplicable process, begin to associate a word with the particular ideas joined by a given habit. For instance, the word ‘salty’ may bring to mind the idea of the taste of olives and engage the habit of bringing to mind the ideas of other salty tastes such as that of pickles (T 1.1.7). As Hume says, “All abstract ideas are really nothing but particular ones, consider’d in a certain light; but being annex’d 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” (T 1.2.3.5, SBN 34).50 Thus an abstract idea is the idea of some particular thing insofar as it resembles in a certain way various other particular things. The particular idea is used as a general representative or proxy for

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the various ideas of the various particulars that share the characteristic.

The idea of extension is an abstract or general idea in just the way described. The ideas of a whole composed of purple points, a whole composed of cold points, and so on, all resemble in a certain respect, namely, in the manner in which their indivisible parts are arranged. The abstract idea of extension is an idea of some particular extended whole, insofar as it resembles other extended wholes. In other words, the abstract idea is an idea of an extended whole in general. Now it is clearer why Hume uses the terms ‘space’ and ‘extension’ interchangeably. For us the first word suggests a container of extended things while the second suggests a

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characteristic of them. For Hume, however, both terms are terms for extended things in general.

Hume does not say much of the manner of arrangement except that the parts coexist. “For that quality of the co-existence of parts belongs to extension, and is what distinguishes it from duration” (T 1.2.3.8, SBN 36). There is more to the arrangement than coexistence, however, because tastes and smells – qualities that Hume thinks cannot have spatial location – can co-exist (T 1.4.5.10-12, SBN 235-6). From his discussion of infinite divisibility it follows that each indivisible part of extension is right next to its nearest neighbors; there is no distance between them. However this arrangement could be true of simultaneous, barely distinguishable sounds. The best Hume can do to characterize the relevant arrangement of parts is to refer to the arrangement in the context of talking about something extended. This is fine. He is not defining the arrangement; he is only calling our attention to it.

Hume has been charged with circularity in his account of acquiring the idea of space, for it seems as if

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we must already have the idea of the manner of being arranged in order to notice it.

However the charge results

from misunderstanding. The manner in which the points are arranged merely serves to bring to mind other points arrayed in a similar manner by the inexplicable process mentioned above. Such association of particular ideas is a quasi-mechanical causal process. Any noticing of a resemblance is no more than the coming to mind of an

associated particular idea. It is certainly not the application of a general idea. The general idea of space is not had before the habit is established of associating the particular ideas with each other.

The account of the idea of time is very similar to that of the idea of space.

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 the fancy by some particular individual idea of a determinate quantity and quality. (T 1.2.3.6, SBN 34-5)

The idea of time is an idea of a particular succession of objects, insofar as it resembles other successions of objects. Thus the idea of time is the idea of successiveness, or better, of a succession in general. Cases of succession for Hume are any cases of replacement, or alteration, or movement. He gives the example of five successive notes played on a flute (T 1.2.3.10, SBN 36-7). This account explains why Hume uses ‘time’ and ‘duration’ interchangeably. For us, the first word suggests some sort of container for objects with duration, while the second suggests a characteristic of them. For Hume, however, they are both terms for enduring things – that is, things with duration – in general.

Hume concludes, “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” (T 1.2.4.2, SBN 39-40). The idea of a manner or order is not separable from ideas of the things ordered. An idea of a manner or order is a general idea of objects insofar as they are ordered in that manner.

As in the case of indivisible points, Hume investigates the nature of space and time by investigating their ideas. And again this method of investigation is justified by the fact that his concern is with space and time as they appear.

*Against the idea of a vacuum*

Hume’s view is that we can only conceive of space and time by means of abstract, that is, general, ideas. In other words we can only conceive them by means of particular ideas – ideas of particular things – used generally to represent resembling particular things. A consequence of this view is that we cannot conceive of a vacuum, or empty space. Nor can we conceive of time passing with nothing changing. Hume’s view seems open to the objection that of course we can conceive of both a vacuum and a period of time without change. The possibility of such ideas is provided for by Newton’s authoritative conceptions of absolute space and absolute time. Hume responds, however, that we do not actually have these ideas. We only imagine (in some sense) that we do.

These ideas of a vacuum and changeless time would be possible only if the ideas of time and space were literally separable from the ideas of things that occupy them – separable as in Locke’s account of abstraction.54 However Hume has taken care to show that they are not separable. He details his point for time.

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

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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. (T 1.2.3.10, SBN 36)

Nor is the idea of space derived from a particular, separable impression mixed up with the impressions of colored and tangible points. As Hume puts the inference for space: “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” (T 1.2.5.1, SBN 53).

Hume restricts his attention here to the impossibility of the *idea* of a vacuum, and does not explicitly say that a vacuum is impossible. There is no need to. He has already said that space consists of indivisible parts that would be non-existent unless they were colored or tangible. The “absurdity” of alternative views demonstrates

the “truth and reality” of his own. Thus space not only must be conceived to be “fill’d with something real and existent,” it also must really be so (1.2.4.1-3, SBN 39-40).56 Section 1.2.4 is an extended defense of the claim that space consists of colored or solid points. Later he calls extension, a “composition of visible and tangible

objects” (1.2.5.14, SBN 58). In the case of time Hume explicitly switches from talk of there being no *idea* of changeless duration to talk of there being no changeless duration. Since what is at issue, given Hume’s Pyrrhonian Empiricism, is time and space as they appear, it follows that neither empty space nor changeless time can exist. Neither time nor space can appear to us except as indivisible, partless things arranged in the appropriate manner.

Having shown that space is filled with colored or tangible things, Hume is concerned to show that we don’t even have an idea of a vacuum, despite seemingly strong arguments to the contrary. Hume puts his point in a potentially confusing way: Even though we “falsly imagine we can form such an idea” of a vacuum, we cannot really have such an idea (T 1.2.5.14, SBN 58).

How could we literally imagine that we have an idea without having an idea of the imagined idea? On Hume’s account, ideas are like pictures. A picture of a picture of a centaur can be used as a picture of a centaur. Likewise an idea of an idea of a vacuum could be used as an idea of a vacuum. So it does not make sense to say that we literally imagine we have ideas that we cannot really have.

Hume must be using the phrase “falsly imagine we can form such an idea” in another legitimate but not absolutely literal sense. He must mean that we falsely talk as if we have such an idea. We use the phrases ‘empty space’ or ‘vacuum’ as if there were a coherent idea corresponding to these terms. There is not really one, he argues. Instead of a coherent idea we have a confounding of distinct ideas (see also T 1.2.5.21, SBN 61-2). In explaining Hume’s thinking I will limit myself to considering vision, though he gives analogous details for the

sense of touch.

One might think we could get the idea of empty space from an experience of darkness. But, Hume argues, darkness fails to give us any visual impression from which an idea could be copied. Being in a lightless cave, for instance, gives one no visual experience, rather than a visual experience of black. When one sees something black, one can discern parts of it, Hume thinks. However when, as a result of darkness, one lacks visual experience, there are no parts to discern. One gets “no perception different from what a blind man receives from his eyes” (T 1.2.5.11, SBN 57). Thus there are no visual ideas of the lack of something visible. There is only the lack of visual ideas.

This conclusion holds true even if distant visible things appear in the darkness, such as stars in a night sky. The stars give the viewer visual impressions and so ideas, but the darkness does not. In such a case the stars are experienced as distant from each other yet not as spatially separated. They are not experienced as spatially separated because between the impressions of the stars there is no extended impression that could give rise to an idea of space. There is no impression at all, much less one with parts. So, he says of “the very distance, which is interpos’d betwixt them,” it is “nothing but darkness, or the negation of light; without parts, without composition, invariable and indivisible” (T 1.2.5.11, SBN 57). Such a distance cannot give rise to the abstract idea of space, so the idea cannot properly be applied to it (see T 1.2.3.11, SBN 37). Nonetheless the stars are perceived as distant from each other in some sense, because they affect different parts of the eye so that the impressions of them are not directly adjacent. Hume uses the word ‘distance’ of this separation, but calls it an

“invisible and intangible distance” to contrast with extension which is visible or tangible distance.57 Thus he

distinguishes “two kinds of distance” (1.2.5.16-17, SBN 59).

Such a distinction might well seem strange, but it is appropriate if we confine our attention to the world as it appears. We can distinguish distant things between which other things appear, from distant things between which no other things appear. The former distance is “mark’d out by compounded and sensible objects,” whereas the latter is “known only by the manner, in which the distant objects affect the senses” (T 1.2.5.17, SBN

59). The differing ways in which things are experienced can render important differences in the world as it appears. In this case, what makes the difference is whether or not the stars are experienced by means of impressions that have impressions in between. In the world as it appears, the stars are either separated by visible or tangible distance or by invisible and intangible distance, depending, for example, on whether or not the sky is dark.

In a case of stars in the darkness, although we perceive no intervening locations, no parts of space, we assume there are such. Why? Because the idea of invisible and intangible distance is closely related to the idea of visible or tangible distance, and so we confuse them.

First, the angle at which light rays from the distant things strike the eye can be the same whether the distance is invisible and intangible or is visible or tangible: “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” (T 1.2.5.15, SBN 58-9). Hume later retracts his claim that we know the angle, perhaps under further

consideration of Berkeley’s *New Theory of Vision* (A 22, SBN 636).58 But the fact is that the sensations of

moving the eye from direct contemplation of one thing to direct contemplation of another are the same whether the distance is invisible and intangible or is visible or tangible (T 1.2.5.15, SBN 58-9).

Second, invisible and intangible distance can be “converted” into visible or tangible distance merely by putting something between the things. For instance as dawn approaches and the sky gains some color, the distance between two stars can shift to a visible distance. Given Hume’s concern solely with the world as it appears, it is irrelevant that beyond our atmosphere the real space between the stars remains uncolored. He is concerned only with the way the distance is experienced. In fact, as far as Hume is concerned one could convert the invisible and intangible distance between the stars into visible or tangible distance merely by holding a strip of white paper so that the distant stars appear adjacent to each end of the strip. His distinction between visible or tangible distance and invisible and intangible distance is purely a matter of how things appear to the senses. The

impressions of points of the paper are between the impressions of the stars, he thinks, even if the paper is not literally between the stars. Hume assumes, as does for instance Locke,59 that our visual field is like a flat plane: “’Tis commonly allow’d by philosophers, that all bodies, which discover themselves to the eye, appear as if painted on a plane surface, and that their different degrees of remoteness from ourselves are discover’d more by

reason than by the senses” (T 1.2.5.8, SBN 56; see also T 1.2.5.16, SBN 59). In any event invisible and intangible distance has the capability of being converted into visible or tangible distance.

Third, both kinds of distance diminish the force of other qualities of a distant object.

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 distant objects affect the senses. (T 1.2.5.17, SBN 59)

The further your friend’s flashlight is from an object, the dimmer it shines on that object. This is so whether you see the flashlight and the object at the shore, against the backdrop of a lightless sky, or in the woods, against the backdrop of mist and trees.

The first and third of these close relations are instances of resemblance. The second, Hume says, is an instance of cause and effect. Presumably he is assuming that capability, like power, is understood in terms of cause and effect (T 2.1.10, SBN 309-16). So the capability of being converted into visible or tangible distance is understood in terms of cause and effect. These close relations make it easy for the mind to use one idea in the place of the other. When we talk about a case in which the distance is properly speaking invisible and intangible, an idea of visible or tangible distance is likely to come to mind instead. (The mental slip does not seem to go in the other direction, perhaps because the perception of visible or tangible distance is so much more common.) Thus when we think of two distant stars in the night sky we have two ideas without any ideas between them.

Immediately and unawares we add between them an array of spatially minimal ideas endowed, say, with the color black – an array of ideas that can serve as the general idea of space. At first, there is nothing between the

star ideas, so we characterize the distance as ‘empty’. Then immediately there are ideas in between, so we go on to characterize the distance as ‘space’. We don’t notice, however, that we have shifted from an idea of an invisible and intangible distance to an idea of a visible or tangible distance. Thus we talk of ‘empty space’ although we have no coherent idea of such a thing. An idea that would literally be an idea of empty space would have to be an idea with both nothing and something between the ideas of the stars. It would be an idea of invisible and intangible distance that is visible or tangible. Oblivious to the incoherence we come, as time goes on, to use other expressions, such as ‘vacuum,’ interchangeably with ‘empty space.’

Hume uses this account to answer the three seemingly strong arguments for the claim that we have an idea of a vacuum. The first is that we must have an idea of vacuums since we argue about them. Hume’s response is just that we “imagine,” in the way just explained, that we have the idea. The second argument is that we can conceive the matter within a cube to be annihilated without motion of the sides of the cube, and in so doing we are having an idea of a vacuum. Not so, Hume replies, we are rather having an idea of what he has called invisible and intangible distance. The third argument is that we must conceive there to be vacuums in the world in order to conceive there to be room for things to move. If the world were a plenum there would always be something in the way to prevent motion. Invisible and intangible distance can do the same work, says Hume. It is easily converted into visible or tangible distance by things moving in between the bodies that border the invisible and intangible distance. Invisible and intangible distance, not a vacuum, is what we have an idea of (T 1.2.5.22-4, SBN 62-3).

One might object that Hume’s claim to have no idea of empty space is just an artifact of his decision to use the word ‘space’ to refer to one kind of distance. Why not use it to refer to distance in general? Then invisible and intangible distance could be called ‘empty space’ without contradiction. Hume’s reply would be that geometry gives the properties of space. There can be no geometry, however, of invisible and intangible distance. There would be no points to compose lines and planes. A spatial point with neither color nor solidity is a “non-entity” (1.2.4.3, SBN 40). Since there can be no geometry of invisible and intangible distance, it is not

space. In sum, space as dealt with in geometry has parts; invisible and intangible distance lacks parts.

One might further object that Hume is simply discussing appearances of things but not their real natures: “’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.” Thus the charge is that he is merely finessing arguments that there must really be vacuums in the world. Hume blithely responds, “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.” The world as it appears is the only legitimate concern of the Pyrrhonian Empiricist (T 1.2.5.25-6, SBN 63-4).

*Against the idea of time without change*

Just as one cannot conceive of space except by conceiving of objects coexisting, so one cannot conceive of time except by conceiving of objects in succession. Hume’s “doctrine” is “that time is nothing but the manner, in which some real objects exist” (T 1.2.5.28, SBN 64).60 From this doctrine he concludes that we cannot conceive

of a “stedfast and unchangeable” object enduring through time. We only imagine that we can conceive it. Hume promises to consider, “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” (T 1.2.3.11, SBN 37).

The connection between the doctrine and the conclusions is Hume’s denial that a steadfast object endures through time. Here Hume is roughly concerned with the general issue raised by Aristotle, whether there can be time without change.61 His concern is not whether there can be time in a steadfast, changeless universe, or in an empty universe. Clearly, for time as it appears he would think not; if there is no succession then there is no manner in which successive objects exist. As for Newton’s claim that “absolute true, and mathematical time,

of itself, and from its own nature, flows equably without relation to anything external,” he would suspend judgment.62 In any event, his concern is rather with the more immediate cases of particular steadfast objects, such as stones and houses. His claim that these do not endure might seem implausible, and so he has to explain

himself.

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 falshood 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 anything stedfast and unchangeable. (T 1.2.3.11, SBN 37)

Because the idea of time or duration is a general idea of successions, non-successions cannot convey it to the mind. Changeable objects are ones that alter, move, or are replaced by others. Steadfast and unchangeable objects are ones which neither alter nor move, and which are not replaced for a while. The flames in a fireplace are examples of changeable objects, whereas the mantle above the fireplace is an example of a steadfast one. The examples do not have to be external objects, however. When a person is “strongly occupy’d with one thought,” that thought is a steadfast object. Hume specifically contrasts steadfast objects with successions. Steadfast objects are not successions, so cannot convey the idea of duration: “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” (T 1.2.3.7-8, SBN 35-6). Hume goes on to conclude that steadfast objects do not endure, that is, do not have duration.

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. (T 1.2.3.11, SBN 37)

Note that Hume has not argued that steadfast objects are not in time. They are in time, insofar as they are

members of larger successions. It is just that they do not have duration because they are not successions themselves.

Once it is clear that steadfast objects are not successions, it becomes obvious why Hume says we can have no idea of a steadfast object with duration. Duration is successiveness. No impression could give rise to the idea in question unless it were an impression of a succession without successiveness. “But if you cannot point out *any such impression*, you may be certain you are mistaken, when you imagine you have *any such idea*” (T 1.2.5.28, SBN 65).

Despite not being successions and so lacking duration, individual steadfast objects can coexist with successions. For example, the single thought with which the person is strongly occupied can coexist with a “real succession in objects.”63 That person would be “insensible of time” though it would be passing, because there

would not be a succession of impressions reflecting the successions in the world (T 1.2.3.7, SBN 35).

If a steadfast object were a whole made up of a succession of parts, then it would endure. It would be the succession of its parts. Since it does not endure, it has no parts. Yet it coexists with some successions. So bigger, temporally partless things can coexist with smaller temporally partless things.

It is because all steadfast objects coexist with successions that we tend, falsely, to imagine in a confused way that they have duration as well: “But tho’ it be impossible to show 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” (T 1.2.5.29, SBN 65; see also T 1.2.3.11, SBN 37; T 1.2.5.28, SBN 64; T 1.4.2.29, SBN 200-1). Just as there are two kinds of spatial distance so there are two kinds of temporal separation. Objects in time can be separated by an intervening steadfast object (temporal separation by something unchanging, that is, by something without duration), as well as by an intervening succession (temporal separation by something changing, that is, by something with duration). Because of the close relations between these two separations, we tend inadvertently to substitute the second when thinking about the first. Just as we imagine that we have an idea of a vacuum, we imagine we have the idea of an enduring steadfast object.

The relations between the two kinds of temporal separation parallel those between the two kinds of distance, and so Hume only briefly explains the process of arriving at the falsely imagined idea of changeless duration. The reader is clearly meant to fill in the details based on the previous discussion. First we can “consider a stedfast object at five-a-clock, and regard the same at six,” just as we can consider the chiming of the clock at 5:00 and then at 6:00. Between these noticings the action of the mind about its other business can be the same. “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.”64 This is analogous to the motion of the eye being the

same whether attending to things at invisible and intangible distance or at visible or tangible distance. Second, “the object was susceptible of such a number of changes betwixt these appearances.” It might have changed even if it did not. It might have been moved or painted or whatever. So the potential for change in a case of changeless temporal separation puts one in mind of change in a duration. This is analogous to the way the capacity of invisible and intangible distance to be converted into visible or tangible distance relates those two in the mind. Third, qualities of objects separated by a perceived changeless temporal separation undergo the same changes as those separated by a perceived duration: “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.” When one returns one’s gaze to the fire after contemplating the unchanging view out the window for a while, the fire is perceived to have burned down as much as if one had been continuously watching it dance. Analogously, invisible and intangible distance has the same effect on the qualities of distant objects as visible or tangible distance (T 1.2.5.29, SBN 65).

These close relations make us “fancy we have that idea” of duration in which nothing changes. The idea of the steadfast object accompanying the phrase ‘nothing changes’ is replaced by an idea appropriate to the word ‘duration.’ Perhaps the replacement idea is of a close succession of objects each resembling the steadfast object. Thus one talks as if the phrase ‘duration in which nothing changes’ stands for a coherent idea. We then come to use other phrases as equivalent, such as “time without a changeable existence” (T 1.2.5.29, SBN 65).

*Conclusion*

Hume’s system concerning space and time cannot be understood without seeing it as a consequence of his Pyrrhonian Empiricism. His exclusive concern with views forced upon him by appearances leads him to claim that space and time consist of indivisible points and cannot be conceived without them. Very likely he expected that agreement from his readers would come rather easily. After all he was arguing, as he saw it, on the side of common sense concerning the core issue of infinite divisibility, an issue over which “philosophy and common sense . . . have waged most cruel wars with each other” (A 29, SBN 659). Ironically, his discussion of space and time has met with determined resistance. The resistance has been misdirected, however. If one wants to engage Hume concerning his views on space and time, one must at the same time grapple with the skepticism on which they depend.

NOTES

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1. See Norman Kemp Smith, *The Philosophy of David Hume* (London: Macmillan, 1941), 287; C. D. Broad,

“Hume’s Doctrine of Space,” *Proceedings of the British Academy* 47 (1961), 161-76; Antony Flew, “Infinite Divisibility in Hume’s *Treatise,*” in *Hume: A Re-evaluation*, eds. D. W. Livingston and J. T. King (New York: Fordham University Press, 1976), 257-269; and Robert Fogelin, “Hume and Berkeley on the Proofs of Infinite Divisibility,” *The Philosophical Review* 97 (1988), 47-69, and *Hume’s Skepticism in the Treatise of Human Nature* (London: Routledge and Kegan Paul, 1985), 25-37.

1. He does not state this explicitly in the *Treatise*, but see EHU 12.18, SBN 156-7.
2. Here, following Hume, I use ‘image’ in a sense that extends beyond visual images. Cf. Thomas Hobbes, *Human Nature*, in *The English Works of Thomas Hobbes*, ed. W. Molesworth, 11 vols. (London, 1839-45), 4: 3- 9 (ch. 2).
3. Aristotle, *Physics* Bk. III: Ch. 6, and Bk.VIII: Ch. 8; and *On Generation and Corruption* Bk. I: Ch. 2. *The*

*Basic Works of Aristotle*, ed. R. McKeon (New York: Random House, 1941).

1. Bayle gives a similar argument against “Epicurean atoms.” Pierre Bayle, *Historical and Critical Dictionary: Selections*, trans. R. H. Popkin (Indianapolis: Hackett Publishing Co, 1991), s.v. “Zeno of Elea,” note G, p. 360. There was widespread support for Hume’s position on this issue. See Thomas Holden, “Infinite Divisibility and Actual Parts in Hume’s Treatise,” *Hume Studies* 28 (2002), pp. 3-25, and *The Architecture of Matter: Galileo to Kant* (Oxford: Clarendon Press, 2004).
2. Hume likely borrows this notion of the adequacy of an idea from Locke, who says, “Those [ideas] I call *Adequate*, which perfectly represent those Archetypes which the Mind supposes them taken from,” *An Essay concerning Human Understanding*, ed. P. H. Nidditch (Oxford: Clarendon Press, 1975), 2.31.1.
3. Bayle distinguishes the two kinds of parts, then defines ‘aliquot parts’ as “parts of a certain magnitude and of

the same type.” Bayle, *Historical and Critical Dictionary*, 362, 367. For more on the distinction see Marina Frasca-Spada, *Space and the Self in Hume’s Treatise* (Cambridge: Cambridge University Press, 1998), 33-8. 8 Besides Fogelin, “Hume and Berkeley,” 54, see James Franklin, “Achievements and Fallacies in Hume’s

Account of Infinite Divisibility,” *Hume Studies* 20 (1994), 85-101.

1. Or as Hume puts it “1996 right angles.” (T 1.3.1.6, SBN 72) The sum of the interior angles of a polygon is equal to the number of sides minus 2, multiplied by 180 degrees.
2. See Adolf Grünbaum, “Modern Science and Refutation of the Paradoxes of Zeno,” in W. C. Salmon, ed.,

*Zeno’s Paradoxes* (Indianapolis: Bobbs-Merrill, 1970), 165-70.

1. The rational numbers are those that can be expressed as a ratio of two whole integers, e.g. 2/3.
2. The real numbers are the rational numbers along with the algebraic irrational numbers such as the square root of 2 and the transcendental irrational numbers such as pi (B).
3. For strands of this line of thought see Flew and Fogelin.
4. Here I supplement the account of Hume’s scepticism given by Fogelin in this volume. He gives the details of Hume’s specific sceptical arguments, while I give a more general characterization. Our treatments are consistent, I think, except that whereas Fogelin says that Hume’s theory of belief explains his Pyrrhonism, I am inclined to say that Hume’s Pyrrhonism explains his theory of belief. This disagreement may well be merely apparent, however, since Fogelin seems to use ‘Pyrrhonism’ in Hume’s own sense. An expanded version of this section appears in ch. 1 of my *Hume’s Difficulty: Time and Identity in the* Treatise (New York: Routledge, 2008).
5. See Frede’s extended argument that the Pyrrhonians and earlier Academics were subsequently interpreted to be more dogmatic than they really were. Michael Frede, “The Skeptic’s Two Kinds of Assent and the Question of the Possibility of Knowledge,” *Essays in Ancient Philosophy* (Minneapolis: University of Minnesota Press, 1987), 201-22. Popkin thinks Hume’s characterization of Pyrrhonism fits this description. Richard H. Popkin, “David Hume: His Pyrrhonism and his Critique of Pyrrhonism,” in V.C. Chappell, ed. *Hume: A Collection of Critical Essays* (Garden City, NY: Anchor Books, 1966), 55-6. Commentators on which Hume relied were e.g. Cicero, Diogenes Laertius, Montaigne, and Bayle.
6. I am relying for my remarks mainly on Sextus, Frede, and Popkin. See Sextus Empiricus, *Outlines of*

*Scepticism*, ed. J. Annas and J. Barnes (Cambridge: Cambridge University Press, 2000). See also David Fate Norton, *David Hume: Common-Sense Moralist, Sceptical Metaphysician* (Princeton: Princeton University Press, 1982), 255-79. Annas hints at an account like the one I will give, but does not develop it and ends up reading Hume as a dogmatist. Julia Annas, “Hume and Ancient Scepticism,” *Acta Philosophica Fennica* 66 (2000), 271- 85, especially 276 and 279. My characterization of Pyrrhonism is selective in accordance with modern epistemological concerns, so that I ignore, e.g., tranquillity as its aim.

1. Hume would have been familiar with the modern revival of such a view in Mersenne and Gassendi, its

development by Anglican theologians and the Royal Society, and its expression in Boyle, Newton, and Locke. See Richard H. Popkin, *The History of Scepticism from Savonarola to Bayle* (Oxford: Oxford University Press, 2003), 112-27, “Constructive or Mitigated Scepticism,” and Henry van Leeuwen, *The Problem of Certainty in English Thought: 1630-1690* (The Hague: Martinus Nijhoff, 1963). For a wide-ranging history of reasoning without certainty see James Franklin, *The Science of Conjecture: Evidence and Probability before Pascal* (Baltimore: John Hopkins University Press, 2001).

1. David Hume, *The History of England, from the Invasion of Julius Caesar to the Revolution in 1688*, Vol. 6

(Indianapolis: Liberty Fund, 1983), Ch. 70.

1. It may be that Hume was following in the footsteps of the early Academic Carneades, if Carneades is read as a “classical sceptic” in Frede’s sense; see “The Skeptic’s Two Kinds of Assent,” 201).
2. Hume’s restriction in this passage to belief as a result of “probable reasoning” is no real restriction since he

thinks “all knowledge resolves itself into probability” (T 1.4.1.4; SBN 181).

1. The phrase “refin’d reasoning” is from T 1.4.7.7; SBN 268, and “elaborate philosophical researches” from T 1.4.7.15; SBN 273.
2. Cf. Berkeley’s distinction between, for instance, “sound as it is perceived by us, and as it is in itself,” and his

exclusive concern with the former. George Berkeley, *Three Dialogues between Hylas and Philonous*, in *The Works of George Berkeley, Bishop of Cloyne*, ed. A.A. Luce and T.E. Jessop (London: Thomas Nelson and Sons, 1948-57), 174-5, 180-2.

1. I will note these in the course of the essay.
2. Here Hume contrasts being real with being non-existent.
3. The considerations against a framework of both an external world of objects and an internal world of perceptions, “*admit of no answer and produce no conviction*,” as Hume famously says of Berkeley’s philosophy. See EHU 12.15 n. 32, SBN 155.
4. Even if taking space to be a continuum yields the best explanation for the successful use of geometry and the

calculus, there is no conclusive reason why the best explanation must be true.

1. When Hume says, “That whatever *appears* impossible and contradictory upon the comparison of these [adequate] ideas, must be *really* impossible and contradictory without any further excuse or evasion,” he is talking about what is really true of what the ideas are adequate of, in other words, what is really true of the world as it appears. When he speaks of “a real quality of extension” he is speaking of extension as it really appears (T 1.2.2.1-2, SBN 29). For further support of the claim that Hume is concerned with "space and time as apprehended by us" see Michael Ayers, "Berkeley and Hume: a Question of Influence." in R. Rorty, J. B. Schneewind, and Q. Skinner, Philosophy in History: Essays on the Historiography of Philosophy (Cambridge: Cambridge University Press, 1984), 313-14.
2. For me it was arm’s length. The distance will depend on grain size and color, amount of light, background color, one’s visual acuity, etc.
3. A carefully designed experiment would be needed to conclusively establish these conclusions. I write only

from my own crude experiment.

30 At T 1.2.2.3, 1.2.2.5, 1.2.2.9, 1.2.4.14; SBN 30, 31, 32, 43-4.

1. This imprecision of geometric equality enables Hume to answer some standard objections to his discrete geometry. The first objection is that for any unit of extension, no matter how minimal, there is a line segment not composed of a whole number of these units. Simply let there be a right triangle with sides of *n* units. The hypotenuse will be *n*√2 units. Hume’s answer is that there will always be a line segment, for figures large enough to yield an appearance, that is “equal” in his sense to *n*√2 units. The other objection is that on Hume’s discrete geometry some line segments have no midpoint, viz., those composed of an even number of minima, so cannot be bisected by another line. Hume’s answer is that for line segments large enough to yield an appearance, the “halves” will be “equal.” These answers require two amendments to Hume’s geometry of miniscule imprecision. First, he would have to expand his idea of a “common measure” to include not only figures the same size or smaller than the ones being tested, but also ones larger. The danger is that some figures equal on Hume’s definition, repeated the same number of times, would compose unequal figures. This problem would occur if there were an indiscernible difference between the original figures that, after sufficient repetition of them, summed to a discernible difference between the resulting composite figures. Hume would have to say that in such a case the original figures failed the test for equality. Additionally, he would have to say that there is a maximum size beyond which geometry does not apply, just as there is a minimum size. Otherwise even a difference of a single minimum would count against equality, for a huge number of repetitions could make that difference discernible. Both these amendments would be in the spirit of Hume’s empirical approach. The first gives a way of making the non-apparent apparent; the second rules out figures too large to yield an appearance. For the objections see, for instance, Don Garrett, *Cognition and Commitment in Hume’s Philosophy* (Oxford:

Oxford University Press, 1997), 74-5. For additional discussion, see Dale Jacquette, *David Hume’s Critique of Infinity* (Leiden: Brill, 2001).

1. The worry that mimima cannot be arranged in a triangle having sides incommensurable with its hypotenuse

without leaving a sub-minimal gap, is assuaged by realizing that the worry presupposes a precise standard of straightness. See Garrett, *Cognition and Commitment*, 75.

1. Here with the phrase ‘in reality’ Hume indicates the view forced on the mind as opposed to the view being

criticized.

1. Hume allows that because the fundamental principles of geometry “depend on the easiest and least deceitful appearances,” they enable us to draw some conclusions more exact than the eye or touch could determine by themselves. Geometry allows a high degree of “exactness.” It just “falls short of that perfect precision and certainty, which are peculiar to arithmetic and algebra” (T 1.3.1.6, SBN 71-2).
2. Disciples of modern geometry who take a line to be an infinite set of dimensionless points will be untroubled

by Hume’s dilemma. However they would still owe a Pyrrhonian Empiricist an account of the source of their basic concepts, and an explanation why someone should believe in the pure space their geometry purports to describe.

1. Here ‘real’ contrasts with being a non-entity.
2. Hume might further be seen as opposing Newton’s view that space and time are absolute in the sense of providing non-relative frames of reference for inertial motion and the passage of time.
3. The apparent tension between Newton's skeptical empirical method and his pronouncements about absolute

space and time was noticed early on. See Mary Shaw Kuypers, *Studies in the Eighteenth Century Background of Hume's Empiricism* (Minneapolis: University of Minnesota Press, 1930), 19-20.

1. Isaac Newton, “Scholium” to the “Definitions,” *Mathematical Principles of Natural Philosophy*, Vol. 1, trans.
2. Motte and F. Cajori (Berkeley: University of California Press, 1962), 6.
3. Bayle, *Historical and Critical Dictionary*, 359. A source for Bayle’s trilemma is likely Aristotle, *On Generation and Corruption*, Bk. I: Ch. 2, 316 17-317 13. It is likely that Berkeley, who was also influencedby Bayle, was another influence on Hume here. See David Raynor, “‘Minima Sensibilia’ in Berkeley and Hume,” Dialogue 19 (1980): 196-200; and Michael Ayers, “Berkeley and Hume: a Question of Influence,” in R. Rorty, J.
4. Schneewind, and Q. Skinner, *Philosophy in History: Essays on the Historiography of Philosophy*

(Cambridge: Cambridge University Press, 1984), 306-14.

1. Bayle lets it go without saying that what might seem to be a fourth option, namely unextended, divisible parts, makes no sense. Presumably the explanation is that something that takes up no space cannot have spatial parts.
2. Bayle, *Historical and Critical Dictionary* 362.
3. This contrast with being “a non-entity” is what Hume has in mind when he says the smallest parts of space are filled with something “real and existent” and form “a real existence” (T 1.2.4.2-3; SBN 39-40).
4. Bayle’s assumption has been questioned also by supporters of Georg Cantor’s conception of a line as a set of

unextended points. See Adolf Grünbaum, *Modern Science and Zeno’s Paradoxes* (Middletown, CT: Wesleyan University Press, 1967), Ch. 3.

1. Cf. Richard Sorabji, “Atoms and Time Atoms,” in N. Kretzman, ed., *Infinity and Continuity in Ancient and*

*Medieval Thought* (Ithaca: Cornell University Press, 1982), 67. In light of the discussion of vacuums to follow, the definition of ‘touch’ could be emended to read ‘there being no visible or tangible nor invisible and intangible distance between.’

1. An additional objection to an atomistic theory of space is given by H. Weyl. “If a square is built up of

miniature tiles, then there are as many tiles along the diagonal as there are along the side; thus the diagonal should be equal in length to the side.” Again this objection assumes that Humean points have precise shapes and arrangements below our ability to detect them – an assumption Hume does not grant. He need only say that we find there to be more points along the diagonal of a square than along a side. The arrangement that allows this to

happen is beyond us to discover. This situation would be analogous to the way we would find more grains of sand along the diagonal of a square shadow on the beach, when looking down from a boardwalk perhaps.

Hermann Weyl, *Philosophy of Mathematics and Natural Science* (Princeton: Princeton University Press, 1949), 43.

1. H.G. Alexander, ed., *The Leibniz-Clarke Correspondence* (Manchester: Manchester University Press, 1956).
2. Kemp Smith’s suggestion that appeal to ideas of manners is inconsistent with Hume’s empiricism is decisively refuted in Lorne Falkenstein, “Hume on Manners of Disposition and the Ideas of Space and Time,” *Archiv für Geschichte der Philosophie* 79 (1997): 179-201.
3. Broad’s criticism of Hume here seems to confuse ‘continuous’ in the sense of not having discernible gaps

between parts, with ‘continuous’ in the mathematical sense (Broad, 166-7).

1. Here ‘really’ indicates the view forced on the mind as opposed to the view being criticized.
2. For the medieval background of such an account see Julius R. Weinberg, “The Nominalism of Berkeley and Hume,” in *Abstraction, Relation, and Induction* (Madison: University of Wisconsin Press, 1965).
3. The Cartesians also used the terms interchangeably. See Descartes, *Principles of Philosophy*, in *The*

*Philosophical Writings of Descartes*, trans. J. Cottingham, R. Stoothoff, and D. Murdoch, 2 vols. (Cambridge: Cambridge University Press, 1984), 1: 227 (Pt. II Sect. 10).

1. For instance in paragraph 259 of T.H. Green’s General Introduction to Hume’s *A Treatise of Human Nature*

(London, 1878). The charge may be inspired by Kant’s claim that we must have the concept of space – the ability to represent things in spatial arrays – logically prior to experiencing space. This claim, however, is not something Hume would disagree with. His ideas are not like Kant’s formal concepts. Immanuel Kant, *Critique of Pure Reason*, trans. N. K. Smith (New York: St. Martin’s Press, 1965) “Transcendental Aesthetic” §2; see also §4 about the concept of time.

54 See Locke 2.11.9, 2.12.1, 3.3.6-9, 3.6.32.

1. These maxims are first mentioned at T 1.1.3.4, 1.1.7.3; SBN 10, 18-19.
2. Here again Hume is talking about what is really true of the world as it appears.
3. Broad gives an attractive but less textually bound account of the contrast between the two sorts of distance (“Hume’s Doctrine,” 173). Hume also calls invisible and intangible distance “imaginary” when arrived at purely by kinesthetic sensations (T 1.2.5.13, SBN 58) and “fictitious” when confused with extension (T 1.2.5.23, SBN 62).
4. George Berkeley, *An Essay towards a New Theory of Vision*, in *The Works of George Berkeley* in A.A. Luce

and T.E. Jessop, eds., (London: Thomas Nelson and Sons, 1948-57) §§ 4-15.

1. Locke, *Essay concerning Human Understanding*, 2.9.8.
2. Here again being “real” contrasts with being a “non-entity.”
3. *Physics* IV, 11.
4. Newton, *Principia*, 1: 6.
5. Here by ‘real’ Hume means that the succession of objects is outside the mind in the world as it appears, instead of merely being a succession of perceptions in the mind. (Of course there is more to the world as it appears than just what appears to the person “strongly occupy’d with one thought.”)
6. Here “really” indicates how appearance really is as opposed to how it is falsely supposed to be.