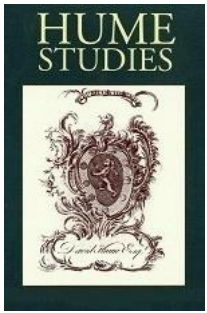

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Hume's Perceptual Relationism

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Abstract: My topic in this paper will be Hume's claim that we have no idea of a vacuum. I offer a novel interpretation of Hume's account of our ideas of extension that makes it clear why those ideas cannot include any ideas of vacuums, and I distinguish my interpretation from prominent readings offered by other Hume scholars. An upshot of Hume's account, I will argue, is his commitment to a remarkable and distinctly Humean view I call "perceptual relationism." Perceptual relationism is a fundamental characteristic of Hume's "universe of the imagination," and a manifestation of just how "loose and separate" the constituents of that inner universe are. Once we understand perceptual relationism and its entailments, we are in a better position to understand the rest of Hume's sometimes puzzling remarks on space and the vacuum.

Hume's discussion of our ideas of space and time in Book 1, part 2 of the *Treatise of Human Nature*[1] has occasioned both perplexity and asperity in many of his interpreters. Several of these interpreters have expressed confusion about the proper interpretation of Hume's views, along with puzzlement about his further philosophical purposes in developing those views. And the interpretive commentary includes recurrent expressions of skepticism about both the logical coherence and the ultimate philosophical value of Hume's position.[2]

Yet there is no doubt that in advancing positions on infinite divisibility and the composition of extension, on the foundations of geometry, and on putative ideas of the vacuum or the plenum, Hume was offering contributions to important foundational topics in mathematics and natural philosophy, topics that were vigor-

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ously debated in his own time. And we know Hume had expressed high hopes that his own science of human nature would yield improvements in these sciences.[3]

My topic in this paper will be Hume's claim that we have no idea of a vacuum, a claim whose defense is the main subject of *Treatise* 1.2.5. My central aim is to make it clear both *why* and *in what sense*, for Hume, our ideas cannot include any ideas of vacuums. Previous interpretations of Hume's discussion have often been hampered, I believe, by a failure to draw clear conceptual distinctions between the one-place properties of *extension* and *length*, on the one hand, and two-place *distance* relations on the other. Due to the failure to attend to these crucial distinctions, important related distinctions among different senses of "vacuum," "void," and "plenum" have sometimes been overlooked. So, I will spend a good deal of time clarifying these distinctions in section two of the article, before moving on to the textual interpretation proper in sections three and four. Part one of the paper will prepare the ground by setting out the general principles of Hume's system regarding space.

An upshot of Hume's account, I will argue, is his commitment to a remarkable and distinctly Humean view I call "perceptual relationism." Perceptual relationism is a fundamental characteristic of Hume's "universe of the imagination," and a manifestation of just how "loose and separate" the constituents of that inner universe are. Once we understand perceptual relationism, along with the important distinction between extensions and distances, we will then be in a better position to understand the rest of Hume's sometimes puzzling doctrines on space and the vacuum. Perceptual relationism is a view about what kinds of ideas we can have, and thus about what kinds of material worlds are *conceivable*. Following my presentation and explanation of perceptual relationism in section three, I will then move on in the last section of the paper to defend an interpretation of how Hume's thinking on how these conceivability questions bears on his further discussion in *Treatise* 1.2.5 of several early modern foundational questions in natural philosophy, questions that are about what kinds of spatial worlds are and are not *possible*, and also about what kinds of spatial worlds might or might not be *actual*.

1. Hume's General Position on Space and Time

Hume's system concerning space and time contains two parts. The first part, which is developed in *Treatise* 1.2.1 and 1.2.2, and defended against objections in *Treatise* 1.2.4, is the denial of infinite divisibility. The denial encompasses both our ideas of extension and extension itself:

> The capacity of the mind is not infinite; consequently, no idea of extension or duration consists of an infinite number of parts or inferior ideas, but of a finite number, and these simple and indivisible: It is therefore

> possible for space and time to exist conformable to this idea: And if it be possible, it is certain they actually do exist conformable to it; since their infinite divisibility is utterly impossible and contradictory. (T 1.2.4.1; SBN 40)

The second part of Hume's system is an account of the intrinsic nature of our ideas of space and time, and it includes his assertion that a vacuum is inconceivable:

> The parts, into which the ideas of space and time resolve themselves, become at last indivisible; and these indivisible parts, being nothing in themselves, are inconceivable when not filled with something real and existent. The ideas of space and time are therefore no separate or distinct ideas, but merely those of the manner or order, in which objects exist: Or in other words, it is impossible to conceive either a vacuum and extension without matter, or a time, when there was no succession or change in any real existence. (T 1.2.4.2; SBN 40–41)

Hume restates the second part of the system at the head of *Treatise* 1.2.5: "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 54). Note that in these passages Hume has identified the concept of a vacuum with the concept of *extension without matter*, or a *space where there is nothing visible or tangible*. It will be very important to keep these specified conceptions of a vacuum in mind as we proceed, since there are other possible ways of understanding the term "vacuum," and some of those ways of understanding the term correspond to situations whose conceivability Hume does *not* deny.

Before discussing Hume's repudiation of ideas of a vacuum, a few interpretive decisions need to be taken. Firstly, one possible source of confusion in Hume's discussion stems from his frequent habit of speaking of *the* idea of space and time. This kind of talk can be misleading in several ways. For one thing, even when Hume is giving an account of only our abstract or general ideas of space and time, there is clearly more than one such idea to be considered. Humean abstract ideas are particular ideas "annexed to a certain term, which gives them a more general signification, and makes them recall upon occasion other individuals, which are similar to them" (T 1.1.7.1; SBN 18). Different people thus possess different abstract ideas of the same thing, and whether an idea is abstract or not for some person depends not on its intrinsic nature, but on how that idea functions within that thinker's entire system of associated ideas. And even a single thinker might employ different abstract ideas at different times for the same general feature of the world.

Now, Hume is clearly attempting to give, at least, an account of all abstract or general ideas of space and time. But I will hold that Hume is not just giving an account of our general ideas of space and time, but means to assert a claim about all our *particular* ideas of space and time as well. Every time one thinks of a spatially extended thing, one employs an idea of extension; and the nature of all such ideas is Hume's topic in laying out his two-part system concerning ideas of space.[4]

A second interpretive issue concerns how we should understand the manner or order in which the components of spatial objects or perceptions are disposed. I believe it is fundamental to Hume's approach that the manner in which these components are disposed is not something separable from the elementary perceptual objects or components themselves. Following Lorne Falkenstein and others,[5] I believe that it is Hume's view that only a distinction of reason can be made between the objects which are spatially disposed, on the one hand, and the spatial disposition of those objects on the other hand.[6]

A closely related issue concerns the relationship between the ways in which the components of spatial perceptions are disposed and the ways in which the components of extended bodies are disposed. In *Treatise* 1.2.1 and 1.2.2, for example, Hume seeks to establish that all of our ideas of space and time are composed of indivisible perceptual minima. He then mounts a striking and controversial argument to the effect that space and time themselves must exist in conformity to those ideas. Are our perceptions of extended things, then, extended in the very same sense in which the spatially disposed objects they represent are extended? Are the perceptual minima that compose our perceptions of extension disposed or arranged in the same kinds of manners in which the spatially disposed objects they represent are disposed or arranged? I will assume the answer to both of these questions is "yes." As a result, we can say Hume is committed to the *spatiality of spatial perception*.

Finally, I believe it is important to notice that the approach Hume takes in *Treatise* 1.2 is straightforwardly representationalist in at least the following sense: Hume appears to presuppose throughout his discussion in this part of the *Treatise* that our impressions of visible objects are caused by external objects that emit or reflect light, and which in turn affect the organs of sensation and the brain to produce impressions.[7] Hume also argues that the external realities of space and time themselves must be similar in certain ways to the impressions they cause, and that we are also bound—under risk of confusion and contradiction—to conceive of these external realities in ways that are not "specifically different" from the perceptions we employ to think about them.[8]

The representationalism in *Treatise* 1.2 seems to stand in some tension with the powerful "sceptical malady" described and exhibited in *Treatise* 1.4. It appears to me that in the earlier *Treatise* 1.2 passage that is our present concern, Hume wishes to leave the deeper skeptical complications of part four in abeyance, so he

can address other issues about space, time, and the representation of space and time by sensation and thought in a manner relevant to the foundational debates of his time, without the additional complication of the powerful skeptical arguments that emerge later in the *Treatise*.

2. A Relationist Framework for Interpreting Hume's Views

Hume's discussion of the ancient dispute concerning a vacuum and a plenum, and his account of our putative ideas of these things, is intended to make a contribution to an ongoing debate which was very much alive, and even acute, in Hume's time. The vacuum was an important topic in the Leibniz-Clarke debate, and the status of the vacuum was a key point of contention between the defenders of the older Cartesian physics and their rising Newtonian rivals.[9] It might be thought that since it is Hume's view that we can have no idea of a vacuum, then he must be committed to the view that every idea of extension we have is an idea of a plenum. If we have no ideas that are ideas of empty space, then must not all of our spatial ideas be ideas of a space that is "full"? But this question is susceptible to ambiguity, an ambiguity Hume discusses directly in connection with the "easily-explained paradox" he introduces near the end of *Treatise* 1.2.5. We will return to that paradox later, but to help interpret Hume's claims in the light of their philosophical context, it will be useful to develop a general conceptual framework within which we can represent some of the main doctrinal alternatives, and along the way introduce some convenient terminology for marking out and distinguishing those alternatives.

We can begin by taking for granted intuitive notions of distance, degrees of distance, and contiguity. Two minima, then, whether bodily or perceptual, will be said to be distant from one another other just in case they are not contiguous. And more broadly, two complex arrangements of minima A and B will be said to be distant from one another if and only if there are no two distinct and contiguous minima C and D such that C is contained in A and D is contained in B. We will assume that whenever we have two pairs of minima, where the elements of the first pair are distant from each other and where the elements of the second pair are likewise distant from each other, we can properly speak of the elements of the first pair as being either more distant, less distant or equally distant in comparison with the elements of the second pair.

I will follow Hume in using "body" and "matter" interchangeably, as I believe he does. Note also that, for Hume, some aggregates of spatial minima form "extensions." Extensions are aggregates of mutually co-existent spatial minima that form unbroken stretches by virtue of the fact that their parts are connected along a single path by the relation of contiguity.[10] It is an important part of Hume's conception of extension that these continua are never infinitely divisible, and always

contain only finitely many minima. Some parts of an extension may themselves be extended, but not all of them will be extended. That is because the minima themselves count as parts of extension,[11] and Hume is explicit in holding that these minima are not themselves extended.[12] So when we need to use a term that is indifferent between spatial minima and the extensions composed of spatial minima, we will simply use "parts of extension" or "components of extension." Whenever we have an aggregate of coexistent parts of extension spatially disposed in some matter, we will say that we have a *spatial system*. Note that any spatial system in which the minima are entirely scattered—that is, in which no two of the minima are contiguous—will be a spatial system none of whose parts are extensions.

We will see that Hume's account of extension and of ideas of extension is best understood as a variety of *relationism*. Relationism in the philosophy of space, time, and motion has been developed along a number of different dimensions, for a variety of philosophical purposes, and with varying degrees of complexity and formal sophistication.[13] But for our limited exegetical purposes here, relationism can be understood as consisting in two parts: the first part is the view that the holding of distance relations between separated material bodies does not depend on whether or not those bodies occupy, or are embedded in, some kind of non-material container space or background space. The second part is the view that the holding of distance relations between separated material bodies does not depend on whether or not something extended lies *between* the bodies. We will refer to the first of these two relationist views as the doctrine of the *independence of matter*, and will refer to the second of the two as the doctrine of the *independence of distance*. Because a proper grasp of Hume's arguments concerning the vacuum depends on having a good intuitive understanding of relationist conceptions of spatial properties and relations, it will be good to dwell on these two doctrines just a bit, beginning with the second part, the independence of distance, since that is the part most likely to lead to confusion.

From our earliest school training in Euclidean geometry, we become accustomed to thinking of all pairs of spatial points A and B as determining a Euclidean line, one segment of which lies entirely between A and B, and has A and B as its endpoints. That connecting line segment has a length, as do all of the other bounded continuous curves that have A and B as their endpoints, and these segments and curves contain other spatial points alike in kind to A and B. In a Euclidean world, the length of those other curves is never less than the length of the line segment, and the only connecting curve with a length exactly equal to that of the connecting line segment is the curve that consists of that line segment itself. We also think of A and B as being distant from each other to some degree, and regard the quantity of the *distance* from A to B as being equal in some way to the *length* of the connecting line segment. We might even think of the length of the line segment as *grounding* or *constituting* the distance between A and B. We thus fall easily into

positing an intimate relationship between length, which is a one-place *property* of a continuous curve, and distance, which is a two-place *relation* between points.

The relationist doctrine of the independence of distance severs this intuitive relationship between length and distance. If the doctrine of the independence of distance holds, then the fact that A is two meters from B, for example, does not entail that A and B are also the endpoints of some continuous, extended line segment or curve that is two meters long. The distance relation can hold even if there is nothing extended whatsoever between A and B. Note that the doctrine of the independence of distance is intended to apply to extensions of any type. It is not just the claim that two *bodies* A and B can lie at some distance from one another even if there is no extended *body* lying between them. It is also intended to imply that A and B can lie at some distance from one another even if there is no continuous expanse of *empty space* lying between them.[14]

Let's turn now to the first of the two relationist views that I described: the doctrine of the *independence of matter*. Instruction in elementary mechanics usually proceeds by starting with the description of a space with a postulated geometric structure, and then moves on to the kinematical description of the motions of massive bodies or field modifications through that space, and the working out of the consequences of dynamical laws governing those motions.[15] The space is thus viewed intuitively as a kind of background against which, or within which, the motions of various material bodies or other physical quantities take place. But according to the doctrine of the independence of matter, we need not take the elementary picture literally, despite whatever value it might possess as a convenient framework of laying out the science of dynamics. The relationist defender of the independence of matter will typically hold that only the bodies themselves are physically real. They will argue that while material bodies can stand in various distance relations among themselves, and move with respect to one another, there need not also exist some extra, non-material spatial stuff that the bodies occupy, penetrate or modify in order for those distances to obtain or motions to occur.[16]

Given a conception of spatial arrangement and distance founded on the twin theses of the independence of distance and the independence of matter, it is nevertheless possible to have "voids" of a certain kind, so long as these are understood in purely relational terms as systems of objects standing some distance from one another other without anything at all lying between them, not even empty immaterial space. I believe Hume makes implicit reference to this kind of void when he asks us to consider "two bodies containing no void within their circumference" at *Treatise* 1.2.4.5. Consider, for example, the difference between a solid red, plane circular patch of one meter radius, on the one hand, and on the other hand an annulus (that is, a ring-shaped region) with an inner radius of 99 centimeters and an outer radius of one meter, and whose one-centimeter outer band is likewise solid red. If we consider some arbitrary red-colored minimum on the inner edge

of the band, we can take it that there will be some other red-colored minimum directly opposite that first minimum, and lying 198 centimeters from the first minimum.[17] I believe Hume wants to affirm the conceivability of a spatial system that consists *entirely* of that annular band, where the colored material points lying in the inner edge of the band can stand in distance relations to one another in the way I just described, but where there is absolutely nothing lying between such pairs of points, not even *empty space*. Such a red annulus coexisting with no other nearby spatial minima, would be an example of a body that does contain a "void within its circumference," even though that circumference contains no vacuum within its circumference; that is, even though there is no extension lying within its circumference that is unoccupied by matter. The solid red circular disk, on the other hand, in addition to containing no vacuum within its circumference, also contains no void within its circumference.

The discussion of the vacuum, and of its conceivability or inconceivability, goes hand in hand with the discussion of the concept of a plenum. Intuitively, a plenum is a region of space that is filled. But if we think in terms of the relational picture of space that accords with the independence of matter and the independence of distance, we have to recognize different manners in which space can be filled. On the one hand, any thinker who denies the existence of empty space must believe in a plenum in a certain *trivial* sense, since all spatially disposed components of extension are then either regions of space filled by actually existing bodies or are actually existing bodies themselves. There will be no empty immaterial spatial regions, or even points, that are not filled with matter. However, such a thinker might at the same time believe that the universe of extension and its parts contains vast relational voids of the kind just described in the previous paragraph. And there is clearly some more robust sense of "plenum" in which belief in the existence of these kinds of voids runs contrary to traditional views according to which the world is a plenum, since a world containing purely relational "gaps" of this kind between bodies could be further filled up with matter. Let us define a *material plenum* as any spatial system that contains some matter but does not contain any unoccupied space, that is, a spatial system in which there is either no space distinct from matter at all, or in which there is some space distinct from matter, but in which that space is all occupied by matter. And let us say that a *relational material void* is a spatial system that contains at least one pair of *bodies* that are non-contiguous, but do not have any other component of extension lying between them. Using these concepts, we can draw a distinction between a spatial system that is a *material plenum containing no relational material voids* and a spatial system that is a *material plenum containing a relational material void*. Every material plenum is either one of the first kind or of the second kind, but never both. Going forward, we will sometimes just use the term "plenum" for "material plenum" and

"relational void" for "relational material void," since there are no other relevant kinds to consider in the context of Hume's discussion.

Finally, let us say that a *vacuum* is any spatial system that consists entirely of unoccupied space, and in which that unoccupied space constitutes an extension. As Hume says, a vacuum is "extension without matter." A vacuum, should one exist, might exist entirely on its own, or as part of a larger spatial system. Here, then, are three key doctrines that I believe Hume wishes to establish in *Treatise* 1.2.5:

1. We can form *no* idea of a spatial system containing a vacuum.
2. We *can* form an idea of a plenum containing relational voids.
3. We *can* form an idea of a plenum containing no relational voids.

These three doctrines comprise three claims about the kinds of spatial world that are, by Hume's lights, conceivable. In the next section I will present Hume's arguments in favor of these claims. Following my discussion of Hume's defense of these doctrines, I will then move on in the last section of the paper to defend an interpretation of the role Hume's perceptual relationism plays in his further discussion of important foundational questions in the natural philosophy of his time.

3. The Luminous Bodies Thought Experiment

The core of Hume's denial of the existence of ideas of a vacuum is contained in his evaluation of an intriguing thought experiment concerning a hypothetical situation in which "amidst an entire darkness, there are luminous bodies presented to us, whose light discovers only these bodies themselves, without giving us any impression of the surrounding objects" (T 1.2.5.8; SBN 56). In order to understand the point Hume wishes to make in considering the luminous bodies thought experiment, we need to understand what Hume means by "darkness." Hume begins his discussion this way:

> 'Tis evident the idea of darkness is no positive idea, but merely the negation of light, or more properly speaking, of coloured and visible objects. A man, who enjoys his sight, receives no other perception from turning his eyes on every side, when entirely depriv'd of light, than what is common to him with one born blind; and 'tis certain such-a-one has no idea either of light or darkness. The consequence of this is, that it is not from the mere removal of visible objects we receive the impression of extension without matter; and that the idea of utter darkness can never be the same with that of vacuum. (T 1.2.5.5; SBN 56–57)

Hume appears to presuppose in this passage that the condition of congenital blindness involves the complete absence of visual impressions—and hence, by the copy principle, visual ideas—of any kind, since such impressions would have to present either darkness or some degree of light, and the person born blind has no perception of either light or darkness. The idea of darkness, on the other hand, which sighted persons *do* possess, consists in the negation of light. Hume does not tell us much about the nature of ideas of that are not "positive ideas"; however, it is clear that he believes the possession of an idea of the absence or negation of light requires possession of the idea of light, and that the idea of light is properly speaking the idea of colored or visible objects. The person born blind, who has never had any visual experience of light, thus has no ideas of either light or darkness.

Now consider the sighted person in some visual setting that is entirely deprived of light. This person certainly does have ideas of colored and visible objects, ideas derived from earlier visible impressions. However, were that sighted person to be in a situation entirely deprived of light, Hume has just said, that person's present visual experiences would be identical to the visual experiences of blind people. In other words, that light-deprived, but sighted, person would have no visual impressions whatsoever. Thus, while the sighted person possesses an idea of darkness, that idea is derived in some way from earlier experiences of light, and not from some present visual impression of darkness representing the light-deprived situation in which the person finds herself, since there is no such thing as a visual impression of darkness alone. We can sum this up by saying that one cannot acquire the idea of darkness simply by being in the dark.

But Hume has argued that our visual ideas of extension are always ideas of colored points arranged in a certain manner.[18] Hume concludes, then, that if there are ideas of extension without matter, they cannot be derived from impressions of darkness and cannot be identical with the idea of utter darkness. Since the idea of utter darkness is an idea of the absence of colored and visible objects, the idea of utter darkness is an idea of the complete *absence* of extension, not the idea of an *existing* but materially *evacuated* extension.

Hume then moves to consider another possibility, that darkness and the removal of visible things can convey the idea of extension without matter, "when mixed with something visible and tangible." The problem in even entertaining this possibility, however, is that we do not in the ordinary course of life experience genuine darkness, much less colored things "in the midst of" genuine darkness.[19] When we have impressions of foreground objects with no visible objects lying between them, we typically perceive those objects against a colored background, so the intervening perceptual space does not appear devoid of colored, visible objects, but instead appears to be filled by the color of the background. Hume says that it is "commonly allowed by philosophers" that all bodies visually appear to us "as if painted on a plain surface," and that we make our judgments about the differ-

ent degrees of remoteness of the foreground and background objects by applying reason to these "plain surface" representations: "When I hold up my hand before me, and spread my fingers, they are separated as perfectly by the blue colour of the firmament, as they could be by any visible object, which I could place betwixt them" (T 1.2.5.8; SBN 57). The luminous bodies thought experiment Hume wishes us to consider, by contrast, invokes luminous bodies presented to us "amidst an entire darkness," not against a colored background.

Another difficulty in even entertaining the possibility of the sort of situation Hume wishes us to consider attaches to the fact that even in a situation in which two small luminous bodies are presented to us in an environment otherwise devoid entirely of other light-emitting bodies, those luminous bodies typically cast some light on the objects in their vicinity. So, Hume underlines the unusual and hypothetical nature of his thought experiment by stipulating it to be one in which the light from those bodies "discovers only these bodies themselves, without giving us any impression of the surrounding objects" (T 1.2.5.8; SBN 57).

Before moving on to consider the lessons Hume wishes to draw from the consideration of this thought experiment, it is worth pausing to eliminate a possible misinterpretation of Hume's example. It might seem plausible to hold that the visual perception of colored, luminous bodies amidst darkness always involves the positioning of those objects against either a black or other darkly colored background. After all, the painter or draughtsman who would attempt to draw such a scene would probably select a colored medium at the dark end of the value scale to represent the negative space in which objects are absent. Or that artist might choose a very darkly colored paper or prepared canvass to represent the darkness. As in the visual arts, so in visual perception, one might think. Hume suggests such an analogy himself between the visual perception of light amidst darkness and the painter's representation of darkness with his comment about the appearance of objects, "as if painted on a plain surface." And John Locke had argued in his *Essay concerning Human Understanding* that some negative realities were represented by positive ideas, and that we can visually represent the absence of light and color via a positive idea of the color of blackness.[20]

Yet, however plausible and historically venerable this analogy might appear, it seems quite clear that it does not represent Hume's understanding of the visual experience involved in his thought experiment. Hume insists that the situation he is asking us to consider is one which is supposed to be quite close to the experience of the person born blind. He asks us to consider the sudden appearance of the luminous bodies as succeeding a condition of complete darkness, and stresses the extremely minimal change from the one situation to the other:

> We may observe, that when two bodies present themselves, where there was formerly an entire darkness, the only change, that is discoverable, is

> in the appearance of these two objects, and that all the rest continues to be as before, a perfect negation of light, and of every coloured or visible object. (T 1.2.5.10; SBN 58)

He reiterates this point twice, just to make sure we do not miss it:

> The sole difference betwixt an absolute darkness and the appearance of two or more visible luminous objects consists, as I said, in the objects themselves, and in the manner they affect our senses. (T 1.2.5.11; SBN 57)

> These bodies are perceived as possessing color, and as disposed in such a manner as to be separated by some distance or other. The rest is a perfect negation of light. (T 1.2.5.12; SBN 57–58)

And Hume has already made it clear that he understands the condition of total darkness for the sighted person to be visually equivalent to the condition of a person born blind, and that he takes the person born blind to have no experience of color whatsoever. Since the sole change that accompanies the introduction of two luminous bodies into this otherwise dark situation is supposed to lie in the objects themselves, along with their colors and manner or arrangement or disposition, the darkness is not to be considered as visually represented by some color, not even the color black.[21]

So, what would we perceive in the hypothetical situation described by the thought experiment? In such a situation, Hume says, we could perceive whether the objects are conjoined or separate, that is, whether they are related by contiguity or distance, two of the relations Hume has described as falling among the species of relation involving space and time. If we perceive them as separate, we can perceive the degree to which they are separate. And if the bodies are in motion, we can perceive the corresponding increase or diminution of the relation of distance between them (T 1.2.5.10; SBN 57).

But the distance we perceive in the illuminated bodies thought experiment is, as Hume describes it, "invisible and intangible." In ordinary cases, by contrast, when we perceive two bodies to be spatially distant or separated to any degree, we perceive them to be separated by a "visible or tangible" distance. That is, we ordinary perceive distant bodies to be separated by an extended expanse of color, even if only the color of a background such as the blue color of the firmament. But visually perceiving the *invisible* distance does not depend on perceiving the bodies as separated by any visible, colored bodies or colored expanse; it does not require the perception of some separate expanse of color that we can distinguish from the bodies themselves.[22] And since the visual perception of extension *does* involve the perception of colored points disposed in some particular manner, this

means that the visual perception of the invisible distance between two bodies does not require the perception of extension without matter:

> Now since this distance causes no perception different from what a blind man receives from his eyes, or what is conveyed to us in the darkest night, it must partake of the same properties: And as blindness and darkness afford us no ideas of extension, it is impossible that the dark and undistinguishable distance betwixt two bodies can ever produce that idea. (T 1.2.5.11; SBN 58)

It is a consequence of this understanding of the perception of distance that Hume is committed to a view that I will call *perceptual relationism*. Recalling our earlier discussion of manners of disposition and the spatiality of visual perception, let us say that when a person experiences some complex visual perception which presents any number of visual minima disposed at various distances from one another, then *perceptual distance relations* hold among those visual minima. We can then express perceptual relationism as follows:

> **Perceptual Relationism**: The holding of perceptual distance relations among any two coexistent perceptual minima A and B that are both part of some complex perception does not depend on whether or not there are any other perceptual minima coexistent with A and B, and that are perceived as either disposed *between* A and B, or disposed in any other manner whatsoever with respect to A and B.

On Hume's view, as a consequence of perceptual relationism, it is possible to have visual perceptions consisting *entirely* of some very small number of minimal visual elements, even as few as two, disposed at some perceptual distance from one another. Those minimal perceptions need not be embedded in any extended perceptual ground or field, or unifying perceptual cement. Just as, for the spatial relationist, material bodies can stand in distance relations even if there is no background container space in which those bodies are embedded, so for Hume the components of visual perception can be disposed at some visual distance one from another, even if those components are not embedded in some background "inner space" that separates them.[23]

Now it follows that if we can have no visual idea of empty space, of extension without matter, then every visual idea we possess must be an idea of a material plenum of some kind. Insofar as we have perceptions of extension and components of extension of any kind, we perceive all such components as "filled" by color or body. But note that Hume does *not* say that we can only perceive and conceive the world as a *plenum containing no relational material voids*. The world need not appear as spatially saturated or "full." The luminous bodies thought experiment

contemplates a situation in which we perceive a material plenum containing a relational void, not a plenum containing no relational voids. Hume only insists that when we do have perceptions of such situations, we must not understand these perceptions as representing a situation in which the luminous bodies are separated by some kind of matter-free, color-free, invisible extension—that is, as empty space. We are, therefore, not conceiving a *vacuum* when we form an idea of two luminous bodies amidst a total darkness.

By closely examining Hume's luminous bodies thought experiment, we have brought out a fundamental feature of Hume's understanding of visual experience and of our ideas of extension. With this understanding in hand, we are now in a position to clarify several of the other puzzling passages in the *Treatise* that occur in the context of Hume's discussion of the second part of his system concerning space and time. In the next and final section of this paper, I will develop some of the consequences of perceptual relationism for the interpretation of those passages.

4. The Role of Perceptual Relationism in Hume's System

In this final section of my paper, I will discuss the bearing of Hume's perceptual relationism on the more comprehensive account of extension, distance, and our *ideas* of extension and distance, that Hume develops in defending the second part of his system of space and time in *Treatise* 1.2.5. First, we will examine Hume's account of how we should respond to the classic problem of the evacuated chamber. We will then consider the question of whether Hume goes beyond the claim that a vacuum is *inconceivable* to the more robust modal claim that a vacuum is *impossible*. Finally, we will turn to Hume's resolution of the puzzling "paradox" about the vacuum and the plenum which we mentioned earlier in this paper.

4.1. The Evacuated Chamber

Hume considers three objections to his claim that we have no idea of a vacuum. The second objection concerns a classic conundrum about a chamber from which all of the enclosed matter has been annihilated by, as Hume puts it, "the omnipotence of the deity" (T 1.2.5.3; SBN 54–55). If it is accepted that the annihilation of all of the matter inside any enclosed chamber is both possible and conceivable, and that this can happen without any changes in the positions or motions of the walls of the chamber, the question arises as to how we conceive the situation that ensues once the chamber has been evacuated.

This question was particularly acute in Hume's time because, with the rise of the new pneumatics,[24] it was held to be the case in many quarters that ordinary, non-omnipotent and non-deified human beings had actually achieved the evacuation of all air from some enclosed spaces, and in some cases this contention was

extended to the view that natural philosophers had succeed in evacuating all matter altogether from these enclosed spaces. In stating the second objection to his account, Hume portrays it as presenting us with a choice between a grossly unacceptable Cartesian account of an ineffaceable plenum containing no relational voids and a vacuum-affirming Newtonian response:

> There are some metaphysicians, who answer, that since matter and extension are the same, the annihilation of one necessarily implies that of the other; and there being now no distance betwixt the walls of the chamber, they touch each other; in the same manner as my hand touches the paper, which is immediately before me. But though this answer be very common, I defy these metaphysicians to conceive the matter according to their hypothesis, or imagine the floor and roof, with all the opposite sides of the chamber, to touch each other, while they continue in rest, and preserve the same position. For how can the two walls, that run from south to north, touch each other, while they touch the opposite ends of two walls, that run from east to west? And how can the floor and roof ever meet, while they are separated by the four walls, that lie in a contrary position? If you change their position, you suppose a motion. If you conceive any thing betwixt them, you suppose a new creation. But keeping strictly to the two ideas of rest and annihilation, it is evident, that the idea, which results from them, is not that of a contact of parts, but something else; which is concluded to be the idea of a vacuum. (T 1.2.5.3; SBN 55–56)

Briefly stated, the objection is that the idea one forms of a chamber from which all matter has been evacuated must be *either* the idea of a chamber in which the opposite and formerly separated walls are now in contact, despite the fact that they underwent no motion as a result of the evacuation, *or* the idea of a chamber that encloses empty space. So, if one grants that it is evident that the resulting idea is not an idea of contact between the opposite walls, one is then committed to the conclusion that the idea is an idea of empty space; that is, it is an idea of extension without matter, or a vacuum.

Hume's response to this objection diagnoses the dilemma it poses as a false one, and relies on his perceptual relationist account of spatial perception, and the accompanying distinction between distance and extension, which allows us to conceive the evacuated chamber as *neither* a situation in which the absence of intervening matter entails that there is no remaining distance between the opposed walls of the chamber, *nor* as one in which the perseverance of those distance relations in the absence of matter means that the chamber now surrounds a region of empty Newtonian space, or "extension without matter." He also points out that the perception of a chamber from which all enclosed matter has been eliminated

is not qualitatively different from the perception of a chamber that does contain matter, but in which that matter is invisible to us:

> We may make almost the same answer to the second objection, deriv'd from the conjunction of the ideas of rest and annihilation. When every thing is annihilated in the chamber, and the walls continue immoveable, the chamber must be conceiv'd much in the same manner as at present, when the air that fills it, is not an object of the senses. This annihilation leaves to the *eye*, that fictitious distance, which is discover'd by the different parts of the organ, that are affected, and by the degrees of light and shade; and to the *feeling*, that which consists in a sensation of motion in the hand, or other member of the body. In vain shou'd we search any farther. On whichever side we turn this subject, we shall find that these are the only impressions such an object can produce after the suppos'd annihilation; and it has already been remark'd, that impressions can give rise to no ideas, but to such as resemble them. (T 1.2.5.23; SBN 63–64)

Hume's relationist account of spatial perception allows him to say that we can perceive the walls of the chamber to be disposed in the same manner they were disposed originally, standing in distance relations that do not require for their support any intervening extension falling between the distant objects. That is, we can conceive of the bounding structures of the chamber as forming a relational void, a three-dimensional analog to the two-dimensional annular disk we discussed in section two.

At this point, we would do well to develop more carefully Hume's distinction between invisible and intangible distance, on the one hand, and visible and tangible distance on the other. But since, as before, we will be focusing entirely on visual perceptions and not tactile perceptions, we can drop the references to what is tangible or intangible, and attend only to the distinction between visible distances and invisible distances.

To help sharpen our understanding of the distinction, let us amplify Hume's consideration of the luminous bodies thought experiment by considering three distinct types of situation in which we might be presented with two luminous bodies whose light presents only those bodies themselves, without giving us any impression of surrounding objects:

1. We are presented with two luminous bodies A and B, which are at some distance separated from each other, and where there is nothing extended whatsoever lying between them.

2. We are presented with two luminous bodies A and B, which are at some distance separated from each other, and between which there lies some extended stretch of matter which is also illuminated.

3. We are presented with two luminous bodies A and B, which are at some distance separated from each other, and between which there lies some extended stretch of matter which is not illuminated either by the emission of its own light, or by reflected light thrown on it by A and B.

To consider these three cases in the right way, imagine that in each case the description describes the *entire* contents of the visual scene with which we are presented at the time in which that presentation occurs.

The first situation constitutes what we have called a relational void. It consists entirely of two objects standing in some distance relation, with nothing extended whatsoever lying between them, neither matter of any kind or empty space. The other two situations constitute cases in which the two bodies A and B bound a genuine extension. However, the extension in the third situation is *invisible*, since it emits no light of its own, and is not illuminated by light from the nearby bodies A and B. The extension in the second situation, on the other hand, is visible to us.

Clearly, in the first and third situations the visual scene will appear to the viewer in exactly the same way: they will be qualitatively indistinguishable. And I think it is important to make note of this fact in understanding what Hume is talking about when he refers to the distinction between visible distances and invisible distances. Whether the distance between two objects A and B is visible or not is a clearly a relational property that distance bears to some third external thing, namely, a viewer. On the other hand, there is a different distinction we can draw that has to do with the foundation of the distance itself. Some distances, like those described in both the second and third cases presented above are, we can say, *mixed with extension*: there is some extended stuff lying between the bodies, and which serves to separate them. Other distances, such as the distance described in the first case, are *relational voids*: the bodies are separated, but there is nothing whatsoever lying between them, and that serves to separate them.

We should not confuse the distinction between visible and invisible distance with the distinction between distances that are mixed with extension and those which are not mixed with extension, and are instead relational voids. The distance described in the first situation is both invisible and a relational void; and the distance described in the second situation is both visible and mixed with extension. But the distance described in the third situation is both invisible and mixed with extension. Clearly, Hume recognizes the difference between a distance that is mixed with extension, but happens to be invisible, and one that is invisible because it is not mixed with extension at all. Hume invokes this distinction in the passage I quoted earlier that presents his response to the evacuated chamber.

Imagine the chamber in question to be made of transparent glass. If we were to view the chamber both before and after all matter within it has been evacuated, it would look no different after the evacuation than a chamber that still contains some matter, say dry air, that happens to be entirely invisible to us.

4.2. Is a Vacuum Impossible?

The first part of Hume's system concerning space and time, the denial of infinite divisibility, is not restricted to the denial of *infinitely divisible ideas* of extension. Nor is it simply the denial of ideas of infinitely divisible extension. Hume goes further and draws a conclusion about space or extension itself. Hume argues that no finite extension is or could be infinitely divisible (T 1.2.2.2; SBN 30–31). Instead, every finite extension is ultimately composed of a finite number of indivisible parts (T 1.2.4.1; SBN 40). We should ask, then, whether Hume means to draw a similarly strong conclusion from his discussion of the vacuum. Given that we have no *ideas* of extension without matter, does it follow, by Hume's lights, that there can *be* no extension without matter? And does Hume move from his perceptual relationism about our *ideas* of extension and the spatial disposition of matter to a relationist view of extension itself and the spatial disposition of matter?

Donald Baxter answers "yes" to the first question. While noting that Hume does not explicitly say that a spatial vacuum is impossible, Baxter concludes: "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."[25] But I do not believe that Hume commits to quite the same type of strong conclusion in the case of the vacuum that he gives us in the case of infinite divisibility. Hume does clearly affirm that nothing ever *appears* to us as an extension without matter. Nor does there appear to be any way in which this idea could be derived in some less immediate way from other impressions and ideas. That is part of what the luminous bodies thought experiment is supposed to establish. We have no ideas of extension without matter. And since we have no ideas of extension without matter, extension without matter is inconceivable for us. We cannot conceive of a vacuum.

But Hume sometimes makes reference to *supposing* something to be the case that is nevertheless inconceivable. When we do this, we can speak of matters in a way such that we do not quite understand what we are saying. One such supposition, Hume says, is the supposition of infinitely divisible extension. Not only do we have no idea of an infinitely divisible extension, but the supposition of an infinitely divisible extension is "utterly impossible and contradictory" (T 1.2.4.1; SBN 39). And therefore, no finite extension can be infinitely divisible.[26]

This line of thinking might lead us to suspect that, for Hume, just as the supposition of an infinitely divisible extension is ultimately absurd and contradictory,

the supposition of a vacuum is equally absurd and contradictory, and thus extension without matter simply cannot exist. But I do not believe that Hume ever makes such a definitive statement about the impossibility of a vacuum, or even commits to such a statement implicitly. Rather, he sounds a more cautionary note. After considering the objection that his reasoning explains "only the manner in which objects affect the senses, without endeavoring to account for their real nature and operations," Hume points out that he has made no attempt "to explain the cause, which separates bodies after this manner, and gives them a capacity of receiving others betwixt them, without any impulse or penetration." He then continues to answer the objection:

> I answer this objection, by pleading guilty, and by confessing that my intention never was to penetrate into the nature of bodies, or explain the secret causes of their operations. For besides that this belongs not to my present purpose, I am afraid, that such an enterprise is beyond the reach of human understanding, and that we can never pretend to know body otherwise than by those external properties, which discover themselves to the senses. (T 1.2.5.25–26; SBN 64–65)

So, given the opportunity here to pronounce a negative judgment upon the possibility of a vacuum, Hume demurs. He appears here to adopt an agnostic attitude about the ultimate cause of the separation of distant bodies, and does not appear to be willing to assert outright the impossibility and contradictoriness of extension without matter. That contrasts with his position on infinite divisibility. In his discussion of that latter topic, Hume did not simply say that he was not attempting to penetrate into the ultimate nature of the composition and divisibility of extended things, but was also quite definite in asserting that whatever else might be true of the composition of extended things, we can know that these things *cannot* have infinitely many parts and *cannot* be infinitely divisible.

But even though Hume does not decisively assert the unreality of extension without matter, he is clear in asserting that extension without matter is *inconceivable*, and so that insofar as we restrict ourselves to making suppositions about the world that lie within the scope of what we can conceive, and entertain hypotheses about the unobserved parts of the world that conform with the world as it appears to us, we ought not suppose the existence of extension without matter. Rather, every *conceivable* possibility, to the extent it represents extension, represents that extension as filled with matter, color or body.

So, either a vacuum is impossible outright or inconceivable at best. But how are we to characterize, then, distances that appear to us as invisible and intangible; and that upon all investigations of such kind as we are presently capable do not yield any detectable material contents? There are two *conceivable* possibilities:

the extended world might contain genuine relational voids—parts of extension separated in a purely relational manner by distance, with nothing extended at all lying between them—or the world might be an actual material plenum containing no relational voids, in which the distances between gross bodies are filled with matter that we cannot see or detect, or at least cannot yet detect—some aetherial matter perhaps—and which in some way is the hidden cause of the separation between bodies. Hume recognizes the possibility, though not the necessity, of the apparently empty spaces between objects being filled by matter that happens to be invisible.[27]

4.3. The "Easily Explained" Paradox

Hume concludes Treatise 1.2.5 with the statement of what he calls a "paradox":

> I shall conclude this subject of extension with a paradox, which will easily be explained from the foregoing reasoning. This paradox is, that if you are pleased to give to the invisible and intangible distance, or in other words, to the capacity of becoming a visible and tangible distance, the name of a vacuum, extension and matter are the same, and yet there is a vacuum. If you will not give it that name, motion is possible in a plenum, without any impulse in infinitum, without returning in a circle, and without penetration. But however we may express ourselves, we must always confess, that we have no idea of any real extension without filling it with sensible objects, and conceiving its parts as visible or tangible. (T 1.2.5.27; SBN 64)

Despite the fact that Hume says this paradox is "easily explained," this passage has been found confusing by some very prominent interpreters,[28] and with good reason. It is hard even to determine what the paradox *is*, much less how Hume means to explain it. But I believe that the interpretation outlined in this paper provides the tools for a very plausible interpretation of the paradox.

I believe Hume sees his perceptual relationist account of our spatial ideas as providing the basis for a clever third way between the Cartesian and Newtonian doctrines on matter and extension, and as thereby making good on his professed hope to develop from his science of human nature a foundation "almost entirely new" for the sciences of mathematics and natural philosophy. He is holding up his relationist approach as a challenge to those who would affirm that the Cartesian and Newtonian pictures exhaust the viable options. For people in the grip of this false dilemma, Hume surmises, Hume's own approach could be seen as paradoxical. We might imagine this type of thinker—the "traditionalists" one might call them—arguing as follows:

> Either the world is a plenum or a vacuum exists. That is because either matter is identical to extension (Descartes) or it is not and it moves in absolute space (Newton). If matter and space are identical, then there is no empty space and the world is a plenum. In that case, the only kinds of motion that can occur are vortical motion in a circle, linear impulse in infinitum and penetration. If matter and space are not identical, however, and some other variety of motion can occur, then the world must contain empty spaces, and so a vacuum exists.

Hume has argued, however, that the world might be *neither* a plenum containing no relational voids—a plenum in the intuitive, traditional sense of a materially "full" world, and the kind of plenum to which Descartes was apparently committed—*nor* a system containing empty, unoccupied space, that is, extension without matter, which is the kind of world to which Newton was committed. Rather, the word might contain relational voids. But this plenum with relational voids might consist of very sparsely disposed material bodies, often standing at distances from one another with no other bodies lying between them.

In the statement of the paradox, Hume is implicitly considering the possibility that a critic might say that he has defined "vacuum" too strictly, and that the term should be taken as referring to any non-material gap between bodies, whether the gap is merely a relational void or a genuine, substantive expanse of empty extension such as some region of Newtonian absolute space. But Hume then goes on in the cited passage to make the point that no matter which definition of "vacuum" one adopts, one is forced to accept possibilities that the traditionalists would find paradoxical. The paradox is easily resolved, however, once one sees that the perceptual relationist account developed by Hume opens up a new conceptual space in the crabbed false alternative of the traditionalists. A reconstruction of Hume's *resolution* of paradox, then, might run like this:

> Suppose we just use "vacuum" to refer to any non-matter-filled distance holding between bodies, something that may just be a relational void: two separated bodies for which there is nothing material and nothing extended whatsoever lying between them, but which are capable of receiving bodies between them without otherwise undergoing any change in color, or in manner of arrangement or disposition. In this case, we still do not have any extension without matter. But we have a vacuum. ("Incoherent!" says the traditionalist.)
>
> But suppose instead we use "vacuum" in our original, strict sense to refer to extension without matter. Then a vacuum is inconceivable. So, should we then say that the only thing conceivable is a plenum? Well, yes, if by "plenum" we mean only a *plenum possibly containing relational voids*. But in *that* kind of

> plenum, it is still possible to have motion without having penetration, circular motion or impulse in infinitum. ("Paradoxical!" rails the traditionalist.)

But in responding to each half of the dilemma, our perplexed traditionalist has erred in failing to recognize the conceptual coherence of a third alternative: a situation in which there is no empty space, but where there are relational voids. In such a case, a body that is part of some system of bodies can move in such a way that it ends up differently located with respect to all of the other bodies, even if those others bodies have not moved with respect to one another.

NOTES

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1 References to the *Treatise* are to Hume, *A Treatise of Human Nature*, ed. Norton and Norton, hereafter cited in the text as "T" followed by Book, part, section, and paragraph number, and to Hume, *A Treatise of Human Nature*, ed. Selby-Bigge, rev. by Nidditch, cited in the text as "SBN" followed by the page number.

2 For some classic examples of interpretations in this spirit, see especially Broad, "Hume's Doctrine"; Flew, "Infinite Divisibility"; and Fogelin, "Hume and Berkeley."

3 See, for a statement of his intention, T Intro 4 (SBN xv).

4 My views on Hume's understanding of our ideas of space and time have also been heavily influenced by the work of Donald Baxter, especially "Hume's Theory of Space and Time." See also Baxter's *Hume's Difficulty*. Baxter also adopts a relationist reading of Hume to make sense of the latter's discussion of the vacuum. However, a key part of Baxter's reading of Hume is that "we can only conceive of space and time by means of abstract, that is, general ideas" ("Hume's Theory," 136), and Baxter believes this restriction is part of the explanation for why we cannot conceive of a vacuum. My alternative reading, as I have indicated, is that Hume intends to give an account of *all* of our particular ideas of space and time, and that his denial of ideas of a vacuum has nothing essentially to do with his account of abstract or general ideas.

5 See, especially, Falkenstein, "Hume on Manners of Disposition" and "Space and Time."

6 I use the phrase "objects *or* components" here because I take it to be Hume's view that manners of disposition or manners of arrangement pertain *both* to the components of

perceptions themselves, *and* to the objects external to impressions that they represent, and in whose existence we are compelled to believe.

7 This presupposition appears in Hume's brief discussion of the workings of microscopes and telescopes at T 1.2.1.4 (SBN 27–28). Despite these representationalist presuppositions, Hume presents no detailed or systematic account of the nature of the physical and physiological origin of our perceptions. I believe this omission is intentional, and that Hume intends his science of the understanding to be autonomous with respect to natural philosophy and physiology, and to depend as little as possible on conjectures about the origins of impressions.

8 Hume argues for the inconceivability of external objects as specifically different from impressions at both T 1.2.6.8–9 (SBN 67–68) and T 1.4.5.19 (SBN 241). More precisely, he says in the former passage that it is "impossible for us so much as to conceive or form an idea of any thing specifically different from ideas and impressions." He then goes on in the next paragraph, however, to say, "The farthest we can go towards a conception of external objects, when suppos'd *specifically* different from our perceptions, is to form a relative idea of them, without pretending to comprehend the related objects." In order to avoid attributing an outright contradiction to Hume, I believe we must interpret Hume strictly here: he is saying that, in forming a relative idea of an object supposed to be specifically different from a perception, we are not conceiving that object, but advancing *toward* a conception of it.

9 For background on the medieval and early modern philosophical discussion of the vacuum, including the Leibniz—Clarke correspondence, see Grant, *Much Ado About Nothing*. An excellent overview of the debate between the Newtonians and Cartesians on the nature of space can be found in Rynasiewicz, "Newton's Views on Space, Time, and Motion." Further discussion of what was at stake in this debate may be found in Huggett, "What Did Newton Mean by 'Absolute Motion'."

10 It is extremely challenging to define this form of "continuity" in Hume's finitistic setting, and it is clearly not equivalent to the standard, contemporary account of continuity used in analysis and point-set topology. But we will assume that for any two minima A and B in an extension, there is always on Hume's view a finite sequential path of minima from A to B such that any two successive minima in the path are contiguous. For background on the challenges of developing a finitistic geometry, see Van Bendegem, "Finitism in Geometry."

11 As one example of a passage that shows Hume clearly committed to the claim that the indivisible minima are parts of extension, see T 1.2.3.12 (SBN 39).

12 See especially T 1.2.3.13 through T 1.2.3.16 (SBN 39–40).

13 Some important recent discussions of the issues are Friedman, *Foundations of Space-Time Theories*; Nerlich, *The Shape of Space*; Sklar, *Space, Time and Spacetime*.

14 The conceptual separation of our intuitive conception of distance and our intuitive conception of length can be brought out in a modern mathematical setting by carefully distinguishing the *metric* defined on some space from any *measures* that might be defined on that same space. A metric on a set S is a two-place function d defined on the ordered pairs in S X S, assigning to each such pair some real number, and such that all of the following constraints hold:

For all x and y, $d(x,y) \geq 0$

For all x and y, $d(x,y) = 0$ iff $x = y$

For all x and y, $d(x,y) = d(y,x)$

For all x, y and z, $d(x,z) \leq d(x,y) + d(y,z)$.

There is no requirement that the underlying set S have any defined topological structure; nor must it be the case that S is even infinite. A *measure* on S, by contrast, is not defined on ordered pairs in S, but on some appropriate family of subsets of S, and is intended to capture various intuitive conceptions of size, for example, length, area, volume or angle measure. Formal definitions of a measure incorporate additivity assumptions that embody the intuitive idea that the size of a set should always be greater than or equal to the size of the subsets it contains, and that the size of a set should in some sense be equal to the sum of the sizes any disjoint parts into which it can be fully decomposed. The standard Euclidean metric and line measures defined on R^n have the property that distance d between two points x and y is always equal to the measure of least-measured (shortest) curve having x and y as endpoints. However, other possible relationships between metric and measure are possible. For example, in Minkowski spacetime, the four-dimensional Lorentz space L^4, there is always a *maximally* long timelike curve between any two timelike separated points, and the temporal "distance" those two points is always equal to the "length" of that maximally long curve. For standard definitions of metric and measure, see Weisstein, "Metric" and Cortzen and Weisstein, "Measure."

15 For a very clear modern presentation of the rudiments of elementary classical mechanics along these lines, see Taylor, *Classical Mechanics*.

16 Notice that the doctrine of the independence of matter and the doctrine of the independence of distance are logically independent. Either view could, in principle, be maintained consistently with the denial of the other.

17 This last claim needs to be hedged a bit. Hume's finitist account of geometry, distance and magnitude permits the possibility that a region of extended body that appears quite solid and continuous to us is nevertheless constituted of only finitely many minimum components, and so for any arbitrary component in one part of the annular ring there may not be some component that is, precisely speaking, directly across from it. Even the concept of *directly across* is one that, on Hume's account, can only be made sense of and applied by using an inherently imprecise and inexact visual measure.

18 Noted previously in section 1. See T 1.2.3.4 (SBN 34).

19 We might in the case of ordinary life experience a relative absence, severe diminishment or privation of light, but would presumably experience a total absence of light only in very unusual, experimentally arranged circumstances.

20 See Locke, *Essay Concerning Human Understanding*, 2.8.2–7.

21 To resist this interpretation, one might propose that Hume holds black not to be a color, but the mere absence of color. But there are several pieces of direct textual evidence showing that Hume does indeed regard black as a color, and that blackness is thus something other than darkness: "But observing afterwards a globe of black marble and a cube of white, and comparing them with our former object, we find two separate

resemblances, in what formerly seemed, and really is, perfectly inseparable. After a little more practice of this kind, we begin to distinguish the figure from the colour by a distinction of reason; that is, we consider the figure and colour together, since they are in effect the same and undistinguishable" (T 1.1.7.18; SBN 26). Next, "but still keep in our eye the resemblance to the globe of black marble, or that to any other globe of whatever colour or substance" (T 1.1.7.18; SBN 26). And finally, "But afterwards having experience of the other colours of violet, green, red, white, black, and of all the different compositions of these, and finding a resemblance in the disposition of coloured points, of which they are composed, we omit the peculiarities of colour" (T 1.2.3.5; SBN 35).

22 The reading I have offered differs from that given by Dale Jacquette in his "Hume on Infinite Divisibility and the Negative Idea of the Vacuum." Jacquette takes Hume to argue that in our mixed impressions of luminous objects in empty space, "the ambient sensation sources make it possible for the perceiver also to experience the colored background of the objects in space, as much as when the darkened visual background is pitch black as when it appears in the blue sky between the perceiver's outstretched fingers in Hume's instructive comparison" (Jacquette, 429). I have argued, however, that the outstretched fingers example is used by Hume to motivate a contrast with the contrary situation Hume is asking us to imagine—the luminous bodies thought experiment—in which there is *no* ambient light and nothing illuminated by the luminous bodies but the bodies themselves.

23 Miren Boehm has argued in a recent paper ("Filling the Gaps in Hume's Vacuums") that one cannot separate the concepts of extension and distance in Hume, and so if, as Hume says, the invisible and intangible distance is not empty space and thus not an extension, then we must conclude that, for Hume, that invisible and intangible distance is not genuinely a *distance* at all. But if my interpretation of Hume's illuminated bodies thought experiment is correct, it is evident that this interpretation is incorrect. In another recent paper, "Hume on the Idea of a Vacuum," Lorne Falkenstein has argued that Hume's denial of the conceivability of a vacuum fails, because "Hume would have had the resources to explain how we can have an idea of space without content, had he cared to use them" (140). Falkenstein's subsequent discussion of this question, however, does not distinguish clearly between perceiving or conceiving a relational void, on the one hand, and perceiving or conceiving a vacuum, on the other hand. He argues: "Hume's subsequent appeal to the experience of darkness had by the blind is also inadequate. We can grant that just as the experience of darkness had by the blind gives them no idea of space or distance or extension, so it gives us no idea of space or distance or extension. But from this it does not follow that we cannot perceive an empty space between two stars in the otherwise total blackness of the night sky. We perceive the empty space between the two stars by perceiving something the blind cannot perceive: the stars on either side of it and the remote, as opposed to proximate, manner of disposition of those stars. The idea of empty space is a compound idea arising from the idea of visible or tangible objects disposed at some distance from one another" (Falkenstein, 161). The problem is that perceiving a remote manner of disposition between two stars is *not* the same thing as perceiving an empty space between the two stars. The first is simply the perception of a spatial relation holding between the two stars. The latter, if it were possible, would involve the perception of something extended between the stars, something that happens to be empty. For Hume, space is extension, and extension can never be perceived or conceived as unoccupied. So, we never perceive or conceive empty

space. However, that does not prevent us from perceiving or conceiving two bodies to be remotely distant from one another with nothing lying between them.

24 For an account of these developments, see Webster, "The Discovery of Boyle's Law."

25 Baxter, "Hume's Theory," 137.

26 A supposition is not absurd, for Hume, because it involves a *single* idea that is itself inconsistent; but rather, it involves multiple ideas that are mutually contradictory in some way. Every particular idea we have, Hume claims, represents something that is possible.

27 Hume claims that the decision between these two possibilities—a world containing relational voids but no vacuums, and a world that is a plenum in the more robust sense that does not even contain relational voids—cannot be settled by any decisive arguments that he can find. But Hume then appears to opt for relational voids on the strictly practical grounds of conformity to common opinion: "Thus if it be asked, whether or not the invisible and intangible distance be always full of body, or of something that by an improvement of our organs might become visible or tangible, I must acknowledge, that I find no very decisive arguments on either side; though I am inclined to the contrary opinion, as being more suitable to vulgar and popular notions. If THE NEWTONIAN philosophy be rightly understood, it will be found to mean no more. A vacuum is asserted: That is, bodies are said to be placed after such a manner, is to receive bodies betwixt them, without impulsion or penetration. The real nature of this position of bodies is unknown. We are only acquainted with its effects on the senses, and its power of receiving body. Nothing is more suitable to that philosophy, than a modest scepticism to a certain degree, and a fair confession of ignorance in subjects, that exceed all human capacity" (T Appendix; SBN 639). So, it is Hume's view that any apparent references to extension without matter, a vacuum, in the Newtonian philosophy can be reinterpreted so as to entail no more than the presence of the invisible and intangible distances that Hume has described. These distances might be invisible because they are relational voids. But they might also be invisible simply because they contain a kind of matter that happens to be invisible to us, but could be made visible by "an improvement of our senses." Hume is not dogmatically committed to either alternative. Rather, he says, he only "inclines" to the former view as the one more consonant with vulgar and popular notions.

28 See, for example, Kemp Smith's discussion of the paradox in *The Philosophy of David Hume*, 316, and Frasca-Spada's discussion of Kemp Smith's attempted interpretation in Frasca-Spada, *Space and the Self in Hume's* Treatise, 158–59.

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