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Hume's Thoroughly Relationist Ontology of Time

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Abstract: I argue that Hume's philosophy of time is relationist in the following two senses. 1) *Standard definition of relationism*. Time is a succession of indivisible moments. Hence there is no time independent of change. Time is a relational, not substantial feature of the world. 2) *Rigid relationism*. There is no evidence of uniform natural standard for synchronization of clocks. No absolute temporal metric is available. There are countless times, and no time is privileged. Combining 1) and 2) shows that Hume's ontology of time is thoroughly relationist.

Keywords: Hume, ontology of time, relationism, history and philosophy of physics

1 Introduction

In the process of composing his *Treatise of Human Nature* in La Flèche, Pierre Bayle's dictionary entries on Zeno's paradoxes and lectures on physics provided the background for David Hume's understanding of the composition of extension.[1, 2] In Hume's understanding, space is not constituted of infinitesimals. It is made of unextended and indivisible mathematical points. They form real extension. Space is like a pearl necklace, in which parts are arranged one next to the other. Likewise, time is structured of indivisible, successive moments that come one after another like chords in a song. Unlike space, time does not consist of co-existing parts. Co-existence is not a temporal relation. There needs to be succession and perceivable change for there to be time. The present moment is not infinitely

1 Standard abbreviations are used with regard to classical works (Berkeley 1996; Hume 2000, 2007; Locke 1996; Newton 1999, 1952).

2 For the French context of Hume's *Treatise*, see Perinetti (2018).

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divisible, as time's parts would in that case exist simultaneously (Baxter 2016: 173; Ryan 2019: 38–40).

Hume's rejection of infinitesimals and its connection to his epistemology and metaphysics of time is well-known (Wright's 2016 monograph is an excellent example). What has remained an understudied topic is Hume's ontology of time in relation to the doctrine of relationism. It is clear from the outset that his views are closer to relational accounts than substantivalist ones. On defending the substantivalist thesis, Isaac Newton argued for an absolute and universal, imperceptible and non-measurable time (*Principia*, First Book, Scholium to the Definitions). In his view, time itself flows equally. It exists by itself, independently of anything else. The standard relationist view comes from G. W. Leibniz. In his correspondence with Samuel Clarke, he says that time, along with space, is "something merely relative." Leibniz (1989: 324) describes time as "an order of successions." Hume thinks in the same fashion: there is no duration over and above the succession of simple moments. Time as we experience is an abstraction of perceivable change. Although we might hold on to a vulgar belief in an absolute time that flows equally across space, there is no sensory evidence and no adequate, representing idea of such a putative flow.

Hume's position is clearly not a substantivalist one, but it is unclear in what specific sense it can be called relationist. The word 'relationism' is not an exact term. It was not used in the antiquity or the early modern period. It was created, to the best of my knowledge, in the 20th century to interpret 17th and 18th century debates on the nature of space, time, and motion, and to assess the ramifications of relativistic physics.[3] In broad strokes, a relationist on time defends the view that there is no such thing as time itself. If one were to remove all physical objects and mental beings of the universe—including the change which occurs in physical objects and the train of thoughts in the minds of conscious creatures—there would be no time. To provide a cursory definition, the relationist holds on to two theses: i) time is essentially dependent on change, and ii) time is nothing over and above temporal relations, like before and after. Relationists might disagree on how exactly time depends upon change. Yet they agree that without change there is no time.[4] Another

3 I am not sure who is the first one to use the term 'relationism.' Leibniz does not use the term in his correspondence with Clarke in the mid-1710s. Neither did Mach in his *Science of Mechanics* (original German publication in 1893). Even early defenders of Einstein, like Schlick in his *Space and Time in Contemporary Physics* (original German publication in 1917) and Reichenbach in his *The Philosophy of Space and Time* (original German publication in 1928) did not lean on the explicit doctrine of relationism. For an overview of relationism, see Gardner (1977), Mach (1919), Schlick (1963), Reichenbach (1958).

4 Morganti (2017) is an exception.

key feature of relationism is that time is a relation, not a substance, or any kind of self-existing entity. As there is no such thing as time itself, there is no observer-independent structure that provides objective metric for any durations. Temporal intervals between events are not grounded in any 'true' time. They are relative. Roughly and broadly, Aristotle argued for a relationist ontology in the sense that time depends essentially on change,[5] and 20th century relativistic physics implies that there is neither absolute nor universal time. As this essay pursues an understanding of Hume's relationism, I will limit my examination to his early modern predecessors.

The rest of this essay is organized as follows. The next section lays out the relevant early modern theories that came before Hume. Although widely known doctrines, they are an important background for understanding the main argument of this essay. I wish to show that while Hume and his predecessors did not use the term 'relationism', they did devise an ontology of time that is properly relationist. It will be argued that, on some general level, Leibniz and Hume share a common non-absolutist ontology of time. Yet in articulating his relationist views in his correspondence with Clarke, Leibniz leans on ultimate theological and metaphysical principles, namely the principle of sufficient reason and the identity of indiscernibles. Hume's strictly empiricist philosophy of time does not rely on such principles. I will therefore refer to George Berkeley's take on time in his *Principles of Human Knowledge*. His relationism is remarkably close to Hume's as it is based on a corpuscular account of time. Both Berkeley and Hume see time as made of indivisible items succeeding each other. The difference between Berkeley and Hume is that the former is not a conventionalist throughout: the standard of timekeeping is eventually founded on God's good will. For the latter, there is no rational justification for the uniformity of nature, and hence no absolute foundation of temporal intervals. Our belief in a universal true time is a fiction. The subsequent section provides the main argument of this paper, that is, a clarification of what type of relationism Hume maintains in his ontology of time. 1) There is no time without change, that is, succession of indivisible moments. Hence time does not exist substantially, by itself, but in relation to change of objects. 2) There is no evidence for equal natural temporal intervals that would function as a standard for our measures of time. As we do not possess an objective temporal metric, lengths of durations are estimated by subjective sensory perception and with artefactual measuring devices. Time is inherently subjective: there are as many times as there

5 This position is articulated by Bardon (2013). Coope (2005) thinks Aristotle's philosophy of time is drastically different from contemporary ontologies of time, and so it might not fit with 20th century labels.

are minds and timekeepers. The closing section concludes that Hume's position on time is thereby relationist throughout.

2 Early Modern Precursors

For Leibniz, unlike for Newton, bodies move due to their internal active forces, not because of external impressed forces. Hence there is no need to refer to absolute space and time to distinguish rest, inertial motion, and accelerative motion. Leibniz accounts for motion in terms of modifications of living and dead forces (Tho 2017: Section 4.4). He deliberately criticizes substantivalism on space and time in his correspondence with Newton's spokesperson Clarke. In the view of Jeffrey K. McDonough (2019: Section 5.1), Clarke has four key points Leibniz disagrees with:

- "First, space and time are logically and metaphysically prior to physical bodies and events."
- "Second, physical bodies and events exist *within* space and time."
- "Third, although we may distinguish regions, or 'parts,' of space and time, neither space nor time strictly speaking are divisible since no region of space or time could be separated, or 'pulled apart,' from any other region."
- "Fourth, ontologically speaking, space and time may be identified with attributes of God: infinite space just is the attribute of God's *Immensity*, while infinite time just is the attribute of God's *Eternity*."

Leibniz declines Newton's omnipresence theology and criticizes him for violating the principles of sufficient reason and identity of indiscernibles. In his *Opticks*, at the very end of Query 28, Newton refers to space as God's sensorium. By this Newton by and large means that the incorporeal God in infinite space perceives things themselves.[6] Leibniz finds this to be a deeply confused and impious notion. Metaphysically, Newton's absolute space as infinite and completely homogenous violates the principle of sufficient reason. According to Newton, an impressed force determines the direction of the body impressed. Yet infinite and homogenous space does not imply the direction of such a motion. One could in principle rotate the putative absolute space 180°, and this would not make any difference on the direction of any motions. For Leibniz, there should be some reason why God creates the space oriented in one way and not the other. Relatedly, such a space would violate the principle of identity of indiscernibles: there would be two distinct things that exactly resemble each other (Forrest 2010). Not even God could

6 For a thorough analysis of the concept of sensorium in Newton, see Kassler (2018).

tell the difference between a space oriented in one way and another space oriented in the exact opposite way. Applying the principle of sufficient reason, Leibniz (1989: 325) describes time:

> … instants, considered without the things, are nothing at all and that they consist only in the successive order of things; this order remaining the same, one of the two states, namely, that of a supposed anticipation, would not at all differ, nor could be discerned from the other which now is.

This characterization is based on the idea that if God had created the universe in an infinite and perfectly homogenous time, there is no sufficient reason why He would have created the world at one time rather than on some other time. If time is infinite, there is nothing remarkable about the time the world was created. As Newton's philosophy of time does not satisfy Leibniz's principle of sufficient reason, it ought to be rejected.

Instead of a substantive treatment of space and time, Leibniz offers a relational account. Space and time are not things which contain bodies, but relations among things. Distances and durations are relative to bodies and events, not independent of them. This alternative account of time does not base temporal relations in self-existing time. Instead, temporal relations like before and after hold among events. Likewise, parts of time, that is, instants, exist in a succession. An individual instant has no substantial existence. There must be a sequence of instances in order there to be a passage of time.

On some general level, it can be said that both Leibniz and Hume share a common non-absolutist ontology of time. Leibniz's criticism of omnipresence theology[7] and some of his verificationist trends[8] are also hospitable to Hume. Yet Leibniz's criticism of Newton is based on ultimate metaphysical principles. Hume starts at the empirical point and eschews speculation that goes beyond sensory

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7 For Newton, absolute space is infinite in all three directions. Hume maintains we cannot conceive infinities, whether an infinitely small or large object (T 1.2.1.2; SBN 26–7, T 1.2.1.5; SBN 28). This already is inconsistent with Newton's dictum that God is everywhere. Russell (1997) details the way Hume criticizes Clarke's almighty space.

8 Many, for example Earman (1979: 263) and Jolley (2005: 85–6), have noted that Leibniz's principle of the identity of indiscernibles is remarkably like the positivist principle of verifiability. If there is no observable difference in rotating the supposedly homogenous space 180°, then the notion of absolute space becomes meaningless. Such a change would not have any observable consequences; the two different spaces would be perfectly similar. Likewise, Hume does not subscribe to absolute space in sense of pure extension, because our idea of space is derived from tactile and visual impressions (1.2.3.15; SBN 38–9, T 1.2.4.2; SBN 39–40). The term 'absolute space' is meaningless as it cannot be annexed to any impression-based idea (Abstract 7 SBN 648–9, EHU 2.9; SBN 21–2).

appearances (fn. 12 at T 1.2.5.26; SBN 638–9).[9] He recommended Berkeley's *Principles* for the readers of his *Treatise*.[10] In the interpretation of Darren Hynes (2004: 339), Berkeley is a relationist as he treats time inseparable from the changes that constitute time. We experience time as ideas undergo change in our minds. There are as many series of times as there are minds. Like in his idealist theory of matter, time is also made of corpuscles. Matter and time are not outside of mind. They are collections of ideas (Garber 1982: Section 3). In the same way as indivisible ideas constitute material objects, they constitute time. An indivisible part of time does not itself undergo change. There needs to be a plurality of ideas that succeed each other.

Berkeley's plausible source of influence is John Locke's well-known explication of the origin of our idea of time, or duration by means of succession. According to Locke, we get the idea of time from "the reflection of the train of ideas" (*Essay* 2.14.2). After explaining the origin of the idea of duration, he goes on to explain how durations are measured. He expounds on how different lengths of time may be compared. Locke suggests that planetary motions provide the best standards:

> The diurnal, and annual *revolutions of the sun*, as having been from the beginning of nature, constant, regular, and universally observable by all mankind, and supposed equal to one another, have been with reason *made use of for the measure of duration* (*Essay* 2.14.19).

In the quote above, Locke's rhetoric is cautious as he suggests that Earth's rotation and revolution around the Sun is *supposed* to take place at even intervals. This approach may explain the psychological features of time-keeping synchronization. Perhaps humans believe that there is a regular course of nature that is a proper standard for our time-keeping devices, like clocks and calendars. This does not tell us why natural processes are perfectly temporally equal. Berkeley agrees that what Locke suggests is the common-sensical understanding of synchronization:

> Bid your servant meet you at such a time, in such a place, and he shall never stay to deliberate on the meaning of those words: in conceiving that particular time and place, or the motion by which he is to get thither, he finds not the least difficulty. But if time be taken, exclusive of all those particular actions and ideas that diversifie the day, meerly for the continuation of existence, or duration in abstract, then it will perhaps gravel even a philosopher to comprehend it (*Principles*, 97).

9 This does not mean that Hume's philosophy of time is non-metaphysical. I wish to stress the fact that, although Leibniz's and Hume's conclusions concerning time are interestingly analogical, their starting points are very different.

10 Hume made this recommendation in a letter to Ramsay in 1737. The letter was made public by Kozanecki in 1963. For Berkeley's influence on Hume, see Popkin (1964). Note that here I am not referring to the letter published by Morrisroe in early 1970's, which is claimed to be fake (Waldmann 2020).

Although this might be an apt psychological account, it does not answer why some clock is more accurate than another. A realist attitude on clock accuracy would require that two equal temporal intervals be perfectly equal.[11] The information provided by our senses or measuring devices does not tell us whether the lapse between event 1 and event 2 is equal to the lapse between events 2 and 3. Our senses are imperfect, and measurements include error estimates. Therefore Newton, in the Scholium to the Definitions of his *Principia*, points out that notions like time, place and motion "are popularly conceived solely with reference to the objects of sense perception." True and mathematical dimensions, for their part, are unobservable and unmeasurable and can be conceived via the laws of motion.[12] Berkeley trusted that the temporal series in our minds reflect clockwork regularity because they are ultimately based on the goodness of God (Hynes 2004: 339).

Next, I will focus on Hume on time. I shall first analyze the standard relationism which is apparent in his views on time. Then I shall interpret his skepticism concerning absolute measure. This will corroborate the point that his ontology of time instantiates relationism throughout.

3 Hume's Relationism

3.1 Standard Relationism: Connecting Time to Change

In his science of human nature, Hume is interested in the capacity of the human mind, and how we acquire ideas, like the idea of time. He rejects infinitesimals based on his copy principle. A simple idea is caused by and resembles a simple impression. We do not have an idea of infinity. We cannot think of an infinitely small or an infinitely large object (T 1.2.1.2–5; SBN 26–8). In thinking anything, we eventually reach a minimally sensible item. The minimally sensible item is the threshold of our thinking. Going over this threshold destroys the idea in question.

In addition to delineating epistemic restrictions, commentators like Brown (2012), Hakkarainen (2012) and Weintraub (2012) have noted that Hume supports a nominalist metaphysics. In the course of denying abstract ideas, Hume is explicit that "everything in nature is individual" (T 1.1.7.6; SBN 19–20). He thinks it is

11 For Locke's temporal realism, see Bardon (2013: 29).

12 For example, by considering the difference between an object moving with constant velocity within absolute space, and an object moving with accelerative motion within absolute space. In this scenario, the two bodies both move equidistant spatial intervals. The inertially moving body does that in equal times, whereas the accelerating body does that in different times. The concept of velocity in Newton's calculus is also relevant for his notion of absolute time (see Westfall 1993: 44).

absurd that there could be, for example, a general indeterminate triangle "which has no precise proportion of sides and angles" (*Ibid*.; see also T 1.3.1.7; SBN 72–3 and Cottrell 2020: Section 4.a) A 'general triangle' is not only an absurd term of which we have no idea of, but it is also an absurdity "in *fact and reality*" (T 1.1.7.6; SBN 19–20). Hence Hume's copy principle relates to his ontology. The minimal item is the ultimate part of any existent thing; everything that exists is a simple or made of simples.[13] The simple-complex distinction is ontological (Landy 2018: 30). Simples are more fundamental than complexes and complexes less fundamental than simples. Complexes are made of simples. Whenever we think of something complex that is made of parts—like time—we may divide the complex to parts. Jennifer Wright (2016: 61) sums up Hume's nominalistically inclined starting point nicely. "In the case of time," she writes, ultimate parts

> are moments. These moments are ontologically fundamental, playing this role in virtue of being simple and indivisible. For Hume, their simplicity entails that, though they compose durations, they themselves possess no duration.

The parts that constitute time are indivisible simples. An object that is a part of succession is a part of time. Yet it is somewhat confusing to say that parts are moments. This is what Hume himself says: "the indivisible *moments* of time must be fill'd with some real object or existence, whose succession forms the duration, and makes it be conceivable by the mind" (T 1.2.3.17; SBN 39, my emphasis). Moment is a temporal notion.[14] One unchanging, durationless object alone is not temporal in any way. It constitutes time when it is a member of other indivisible and distinct objects that come one after another. An unchangeable object does not have any duration:

> 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 any thing stedfast and unchangeable. For it inevitably follows from thence, that since the idea of duration cannot be deriv'd from such an object, it can never in any propriety or exactness be apply'd to it, nor can any thing unchangeable be ever said to have duration (T 1.2.3.11; SBN 37).

13 For a detailed analysis of Hume's argument for the ontological independence of simple properties, see Hakkarainen (2011).

14 Chamber's dictionary from 1728 (567) defines the term: "MOMENT, in Time, is the most minute, and insensible Division of Time; or what we otherwise call an *Instant*." In Hume moment is also the most minute division of time, but it is not insensible and divisible to infinity.

Hume allows, in 18th century parlance, that a philosopher and the vulgar commonly believe that changeless objects endure by means of fiction.[15] Unchanging duration is to be treated as other fictions, like unity of aggregates and continued existence of unperceived objects (Cottrell 2020: Section 5.b). We have certain ways of talking in our every day lives. We might say, for example, that a sports team is one. Hume thinks that a plurality of things is not one thing but many things.[16] Saying that a society formed by individuals is one thing is a figure of speech. Simple things are more fundamental that complex things because simples constitute complexes and the latter does not exist without the former.

Time is made of many items that are in a succession. For there to be time, the items need to be distinct, so that there is some way to separate the different items. The often-repeated example concerns musical chords. An ongoing chord does not cause the idea of time. It is not temporal in any way, because there is nothing changing in such a sensible object. There should be a chord, another chord, pause, another chord, and so on (Slavov 2019: 398). Only when there is more than one object that is succeeded by another, we may conceive of time:

> …we may conclude, that time cannot make its appearance to the mind, either alone, or attended with a steady unchangeable object, but is always discover'd by some *perceivable* succession of changeable objects (T 1.2.3.7; SBN 35).

As noted before, Hume's science of human nature studies the way humans acquire ideas (and reason with them). This could suggest that he is not interested in the ontology of time at all. Science of human nature is a foundational, epistemic endeavor.[17] Perhaps Hume establishes a foundation and a corrective to all other sciences, like parts of natural philosophy. Reasoning in physics, for example, is "in some measure dependent on the science of Man" as it lies "under the cognizance of men, and" is "judged of by their powers and faculties" (T 0.4; SBN xv). I agree that when Hume assesses the notion of time, he is first and foremost concerned on how we conceive of time and experience temporality. To that end, it is enough for him to explain" the principles and operations of our reasoning faculty, and the nature of our ideas" (T 0.5; SBN xv–vi). This is the main objective of Hume's principal work, "the sole end of his" logic. His positive answer is that time is an abstract idea that represents "manner of appearance," that is, moments succeeding each other (T 1.2.3.5; SBN 34).

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15 For the status of fiction in Hume, see Butler (2010) and Cottrell (2020).

16 Baxter (2007) calls this 'Hume's plurality assumption.' In the context of determinations of extension, Hakkarainen (2019) disagrees. In his view, determinations of extension are unities. This is however different from the composition of time.

17 This is Boehm's (2016) position.

The abstract idea of time presents not a single distinct impression but manners of their disposition (Falkenstein 1997: 179–80).

Still, Hume's epistemic argument has an ontological stretch. We cannot understand time without change. There is no notion of time without change. We can conceive of an object that does not change. An object like this does not however have a duration. Wright (2016: 54) hits the nail on the head:

> His investigation into the concept of time resulted in his tightly binding the concept of time to that of succession. So tightly that he concludes that the idea of time without change is incoherent. This does not tell us that the world exhibits succession and so is temporal. However, it does tell us that, if it does not exhibit succession, there is no sense in our calling it temporal.

Hume is ambiguous on whether there is succession in the mind-independent world without succession of ideas. There *could* "be a real succession in the objects," even though we perceive no successions, and even if there is no one to perceive those successions (T 1.2.3.7; SBN 35). Hume is however explicit that if there is no succession, there is no time. In more general terms, if there is no change, there is no time.

Succession and change are related in the following way. The preceding moment and the proceeding moment are distinguished by means of change. We may differentiate earlier and later bits of time only on the condition that change introduces a difference between them (Wright 2016: 86). There might be perfectly stationary objects, but they do not instantiate temporality in any way. "Time cannot make its appearance to the mind […] alone" (T 1.2.3.7; SBN 35), because the term 'time alone,' or 'time itself' is incoherent. If there is time, there is a succession of objects, that is, change. By connecting change with time, Hume is committed to an ontological thesis.[18] This is typical relationism. In his own words: "Time is nothing but the manner, in which some real objects exist" (T 1.2.5.28; SBN 64–5). This is relationism also in the sense that it stands in a stark contrast to substantivalism. For Hume, time is not a thing. It is the *way* things exist.

18 There is explicit textual evidence that shows Hume's ontological commitment. In T 1.2.4 (SBN 39) Hume considers the finite nature of space and time and claims: "'Tis therefore possible for space and time to exist conformable to this idea: And if it be possible, 'tis certain they actually do exist conformable to it."

3.2 Rigid relationism: Standards of Temporal Measurement are Relative

Hume is a rigid relationist because he denies that there is an absolute standard for clock synchronization. Consequently, there are as many times as there are minds or timepieces. Before making this argument, the problem of clock accuracy must be made clear. An accurate clock is a device that ticks evenly. When a typical wristwatch ticks 60 times a minute, it is accurate if all the intervals between its units are equal. The durations 1–2 s, 2–3 s … 58–59 s, 59–60 s should all be the same. Clocks are subject to various disturbances. They drift.[19] If accuracy is the objective in constructing a clock, there must be some way to synchronize it. This requires a standard of synchronization. There should be a common measure, an ideal clock that ticks perfectly evenly. We could then compare local timekeepers to that ideal standard of time. Different philosophies propose different answers as to what is the correct standard of accuracy. Newton thought it is the absolute, uniform flow of time. Locke thought it is the uniformity of nature, more precisely the regularity of astronomical motions. Berkeley thought it is the goodness of God. Hume thought there is no such standard—or at least we do not have access to it.

Hume does not spill much ink on measurement. He addresses measurement in concert with developing his views on the standards of equality and the status of geometric ratios. In one paragraph, T 1.2.4.24 (SBN 47–9), he analyzes the standards of time-measurement. It is useful to break the paragraph into smaller parts. Hume takes that

1) "A common measure, the notion of any correction beyond what we have instruments and art to make, is a mere fiction of the mind, and useless as well as incomprehensible."
2) "The fiction however is very natural."
3) "This appears very conspicuously with regard to time; where tho' 'tis evident we have no exact method of determining the proportions of parts […] yet the various corrections of our measures, and their different degrees of exactness, have given us an obscure and implicit notion of a perfect and entire equality."

According to the first point, a common measure beyond our technology is an illusion. Perhaps the correct standard can be achieved by means of congruity? We can estimate different proportions, greater, less, and equal, by comparing two objects. Perhaps we could make comparisons, develop technology, and carry out ever more precise measurements. However:

19 This is due to, for example, the materials that constitute the clocks, temperature, relative motion, and gravitational potential.

> We frequently correct our first opinion by a review and reflection; and pronounce those objects to be equal, which at first we esteem'd unequal; and regard an object as less, tho' before it appear'd greater than another. Nor is this the only correction, which these judgments of our senses undergo; but we often discover our error by a juxta-position of the objects; or where that is impracticable, by the use of some common and invariable measure, which being successively apply'd to each, informs us of their different proportions. And even this correction is susceptible of a new correction, and of different degrees of exactness, according to the nature of the instrument, by which we measure the bodies, and the care which we employ in the comparison (T 1.2.4.23; SBN 47).

By using our senses and instruments to assess proportions, we may never be perfectly certain that we have reached a correct judgment. To understand this point, it is necessary to look at Hume's classification of judgments on degrees of quality in *Treatise* 1.3.1. Under closer inspection, he says that it is

> impossible to judge exactly of the degrees of any quality, such as color, taste, heat, cold, when the difference betwixt them is very small; yet 'tis easy to decide, that any of them is superior or inferior to another, when their difference is considerable (T 1.3.1.2; SBN 70).

The consideration above concerns qualitative differences. The basic point can be applied in case of quantities, too. A considerable difference between two objects may be intuited, and hence judged with a high degree of certainty. Small differences are subject to error estimates in measurement. They might be corrected indefinitely by other measurements. Congruity does not provide us an impeccable measure. Accordingly, we do not have access to perfect natural equality.[20] As Hume remarks concerning the second point, such standard is nevertheless very natural to us. Instinctively we, as well as non-human animals, believe in the uniformity of nature (as Hume details in EHU 5 and 9). Regarding the synchronization of clocks, as Locke pointed out, a supposedly natural uniformity is provided by cyclical celestial motions. But even when we try to standardize our measurements with "some common and invariable measure," the corrections we make are always "susceptible of a new correction" (T 1.2.4.23; SBN 47). Periodical processes are not temporally equal like the two expressions in a simple algebraic equation. Measures of rotations and revolutions are constantly corrected. Our calendars need to be adjusted by arbitrary means to match celestial phenomena.

20 Proportions in quantity and number produce perfect equality. Both sides of the equation $x = x$ are the same, so the two ideas form a unity, x, which the mind can clearly and distinctly conceive (T 1.3.1.5; SBN 71). This standard of equality is confined within the relations of ideas. In the *Treatise*, Hume seems to limit this standard to arithmetic and algebra specifically, whereas in the first *Enquiry* 4.1 (SBN 25) geometry is also taken on board.

Investigating natural regularities will never provide us with a perfect equality. The quest for that standard would be a never-ending pursuit.

According to Hume's third and most decisive point, we do not have an "exact method of determining the proportions of parts" of time (T 1.2.4.24; SBN 47–9). If there is no "perfect and entire equality" to compare ticks of a clock, then there are no absolute criteria for judging which clock is the most accurate.[21] This position has intriguing consequences. There is in principle an indefinite number of clocks. The readings of clocks might disagree on the intervals among certain events. Compare clocks A and B.

Clock A. Extinction of the dinosaurs – one tick – turn of the third millennium on Greenwich mean time.

Clock B. Turn of the third millennium on Greenwich mean time – billion ticks – my submission of this essay.

This result is highly counterintuitive. If time is relative, then the temporal interval from the extinction of the dinosaurs to year 2000 could be billion times smaller than from the year 2000–2020. Without absolute and universal time, local measures of time are all there is. There is no common measure of time that dictates which local measure is the 'truest.' There are as many times as there are minds or devises that tick, or whatever we can use to track time. Hume's relationism is rigid. According to his ontology of time, temporal intervals—whether they are subjective experiences of the passage of time or measures performed by artefactual machines —are relative.

Although contrary to common-sense expectation, Hume's relationism is both philosophically and scientifically credible. Take the B-theory of time and the ramifications of relativistic physics. The literature on these issues for the last hundred years is voluminous and growing, so I must be highly selective and concise. According to the B-theory, the earlier/later relation is invariant. Under no circumstances is the second world war earlier than the first, or the first war later than the second. The statements 'WW1 precedes WW2' and 'WW2 succeeds WW1' are true at all times. A notable fact about the two wars is that the first (at least partly) caused the second. Hume happens to think that causation is temporally asymmetrical. Cause is earlier, and effect is later.[22] The order of causally related, timelike separated events is not a relative matter (their time-interval is). This is bolstered by the fact that, in a relativistic account of the world, an event is earlier than a later event if an electromagnetic signal, or a signal slower than it, from an

21 There would still be relative criteria, like synchronization of clocks with a conventionally chosen standard clock.

22 For scholarship on Hume on temporal priority of causes over their effects, see Hausmann (1998), Ryan (2003) and Melamedoff (2019).

earlier event reaches the later event. An observer has a definite past if an event is located within their past light-cone, and a definite future if an event is located within their future light-cone. Grouping together the fixed earlier/later relation of the B-series and the light-cone limitations of the theory of relativity is consistent with the view that a cause begins before its effect. This result holds even in the absence of substantial time. Hume's relational take on time is therefore not only historically interesting, but credible considering the systematic theories in the metaphysics of time.

4 In Conclusion

In this essay, I provided a historically sensitive and a philosophically feasible rendition of Hume's ontology of time. It is relationist in the standard sense: there is no time itself as time is a manner of existence. The way time exists is dependent upon change. It is also relationist in the narrower sense: there is no universal, one and only true time that we all share. There are as many times as there are minds and timekeepers. My two-part argument contributes both to understanding Hume's own ontology of time as well as its place in the larger framework of the substantivalism/relationism debate.

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