Ain't Nobody Got Time for That:
The Nature of the Capacities Inhering in Space that Permit the Illusion of Time

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The thematic strand within science and philosophy of science has been the removal of all traces of anthropocentricism from intellectual thought. This not only includes the anthrodecentralization, as it might be called, in which human centrality and importance to narratives in natural science and philosophical perspectives are removed, but also the gradual breakdown of what the human mind brings narratives, generally. This paper also seeks to do that, illuminating the anthropogenic nature of time, expressing how we might judge that time is anthropogenic, and constructing a worldview that places physical ontology prior to anthropogenic constructs, producing a metaphysics that places change prior to time —which will throw into question whether time has any physical reality; I shall argue it has no *physical* reality. The way to do this is to begin with change as prior to time. Some modicum of qualification will be made to this statement; however, the vigor of the statement is not to be mitigated. Moreover, such mitigation has been relegated to an extension of a larger project that this paper is a part of, and so the qualification will not be presented in the following.

The implicit consensus is that there is some relationship between time and change. The discipline of philosophy has wrangled with the question of what time's structure is, how it works, and whether it exists at all, and the fruit of this wrangling has illustrated that change is roughly as important as time, but it is assumed that time is somehow prior to change. Many maintain that time can pass without change, but not the contrary. That is, as Stephen Mumford has put it, '[p]hilosophers argue about whether there could be time without change, but it surely looks certain that there could not be change without time.'[1] The immediate objective is to refute this suggestion. In the most general manner that it can be stated, the approach to time I shall be advocating is one in which time arises by way of coordinating two types of change, thus is a

[1] Mumford, Stephen. *Metaphysics: A Very Short Introduction*. New York City: Oxford University Press, 2012. p. 55

construct of a physical system that is made possible by change. Based on the strict and exclusive manner in which change will be defined (in terms of potential capacities and actualized capacities), which is contingent upon the nature of space's structure, some exposition of space's structural detail will be propaedeutic to the time discussion. "Change" will be exclusively defined as a capacity of discretized space, which is to say, the essence of time will be, in the end, stripped down to capacities of space itself, leaving no ontological remnant of time. Major concerns about ontological repercussions pertaining to such complex matters as Lorentz symmetry breaking should find satisfactory responses in the works of Hagar and Hemmo. [2, 3]

We begin with space. Change being a property of space, the task at hand is to illustrate how it is that the appearance of time comes to be, and to do so without affording it an affirmation of ontological status. There is an additional feat to be performed. In defying time's priority over change, this project will fly in the face of Theodor Sider's assertion, that 'no sensible presentist would flat-out reject all temporal talk.'[4] This is precisely what shall be done. The feat, then, is to provide the supplementary commentary that stultifies contemporary talk of tense, while permitting such talk to complement human experience, but not spilling over into the real, *physical* world —the world that originates all experience.

The starting point is, not a geometric point, but a discretized piece of space, called the "hodon" by philosophers of time (e.g., van Bendegem).[5] The choice of discrete space is not arbitrary. Change requires it. After a preliminary discussion of presentism, there will be some

[2] Hagar, Amit. "Minimal Length in Quantum Gravity and the Fate of Lorentz Invariance." *Studies in the History and Philosophy of Modern Physics* 40, no. 3 (2009): 259-67.
[3] Hagar, Amit. *Discrete or Continuous? The Quest for Fundamental Length in Modern Physics*. New York: Cambridge University Press, 2014.
[4] Sider, Theodore. *Four-Dimensionalism: An Ontology of Persistence and Time*. New York City: Clarendon Press, 2003. p. 14-5
[5] van Bendegem, Jean Paul. "The Possibility of Discrete Time." In *The Oxford Handbook to the Philosophy of Time*, edited by Craig Callender, 145-62. New York: Oxford University Press, 2013.

discussion as to the importance of discretized space over continuous space, and it shall be argued that there is no immediately obvious way for change or time to spring from continuous space. The natural order for this paper is to progress through the topic of presentism and what it requires, then move on to the model of change-generating space, and close with a demonstration of the force and value of the model.

Presentism

An important point that needs to be made is that there is a problematic assumption entailed in any philosophy of time, in which temporal extension is given a positive ontological status, and I am especially referring to presentist philosophies of time. This assumption becomes clear, when one assesses the "here-now" concept entailed in a variety of presentist frameworks (cite from Belkind and Stein).[6, 7] The general presentist picture of the world can be represented as a coordinate representation, (*M*, t), where '*M*' is the manifold and 't' is an instant. One must ask, "what does any temporally extended picture of *M* entail, so far as assumptions go?" If a spatial coordinate in *M*, x_1, is occupied at t_1, then what does it mean for x_1 to be not occupied at some later time, t_2? Since it is not completely clear what an anti-substantivalist's discretized space would look like, substantivalism will be assumed, i.e., that space is either a substance over and above that substance contained in it, or that space is some pseudo-substance. One finds in the general presentist framework that there is a difficulty in defining and making clear what change is and how it is possible —in the way it is used herein to metaphysically undergird phenomena—, particularly if space is a plenum, not discrete. Keeping the assumption of substantivalism in mind, the treatment this approach yields produces a radically different line of

[6] Belkind, Ori. *Physical Systems: Conceptual Pathways between Flat Space-time and Matter*. (Boston Studies in the Philosophy and History of Science) Vol. 264. New York: Springer, 2012.
[7] Stein, Howard. "On Einstein-Minkowski Space-Time." *Journal of Philosophy* 65 (1968): 5-23.

thought when thinking about something like the block universe, for example.[8] Affording a positive ontological status to proximate temporal points of (x_1, t_1) in *M*, and saying that x_1 was occupied and then not is to miss the point, sweeping a major philosophical issue under the rug. Applying both truth-functional values to x_1, both 1 and 0 (filled and not-filled), is a logical contradiction. This goes, regardless of whether the space is relational or absolute. What this proves is that the space represented by the x-coordinate at times t_1 and t_2 cannot be the same, nor can there be a connection; and thus, being as we must introduce another x-coordinate (because we are talking about two physically distinct pieces of space), x_1', which corresponds to t_2, x_1 and x_1' are not subsets of the same manifold. They are of different, distinct manifolds, otherwise a logical contradiction in predicate possession would exist. What I have presented here is the standard meaning and stereotypical motivation of the notion of "time slices," used by philosophers of time. What this amounts to is the fact that non-presentistic philosophies of time do not just separate events by reifying time, they also implicitly admit distinct plena of space, i.e., they sneak in the backdoor distinct spatial manifolds, not explicitly announced amidst their assumptions, even if there are transfinitely many of these distinct spatial manifolds contained in any time interval. There are two options which seem to leave an unavoidable set of unsatisfactory choices. Either objects (or the parts of space) have disconnected temporal parts, or time is a continuum in which objects (or the parts of space) endure at the expense of logic.[9] In the former case, each time slice is a different space, bearing no relation to others that are

[8] There is a side issue, the debate between absolute and relational motion. It natural follows that the present philosophy of time naturally requires that space be something over and above the objects in it. Though beyond the scope of this text, what follows from the purview of this philosophy of time is that motion is phenomenally relative, yet metaphysically absolute, not so far from Newton's view, in response to Descartes, who accidentally implied the absoluteness of space in his relational scheme. The difference between Newton's and this space is the difference between continuity and discreteness.

[9] In the continuum, we have the sort of thinking found in Vonnegut's Tralfamadorians. See: Huggett, Nick. *Everywhere and Everywhen: Adventures in Physics and Philosophy*. New York City: Oxford University Press, 2010. p. 116-24

supposedly a part of the same chronology; in the latter, the problem of logical contradictions plague enduring pieces —"world lines," if you will— of the space, as factual statements about the world line cannot, in practice, be logically consistent. These are mutually exclusive options, in that (the latter) choice seems to be between logical consistency and change; for change requires something of a former identity to no longer be itself, yet spatial identification of what was and is are no longer to be juxtaposed. Now, enters a physical model to resolve these issues.

Model of Physical Space

The model of space that gives rise to the *possibility* of a constructed time —an illusory byproduct of the physical— is as follows.[10] Suppose that space is composed of discrete pieces, hodons, which are automata-like, in that they may either be occupied or not. We shall refer to this as one of their two "capacities." In this case, the capacity is to come in one of two states, occupied or not. These hodons possess a second capacity, that of being other than they are — occupied if they are not, and not occupied if they are. Furthermore, the occupation must remain somewhere, and so we refer to this second capacity as change, being that the actualized capacity of a particular state is accompanied by an actualization of the contrary elsewhere. The anthropomorphic view, having time so naturally stitched into it, leads one to ask, "well, at what rate does this change occur?" There is a fundamental failure in this question. One can conceive, immediately, of the change independent of time, and it is only through reflection that one asks about the "rate" of change, which is to impose time upon change. Change, as something that occurs in space but not time, is not a natural idea to embrace, because time is so ever-present in

[10] It shall become clear momentarily why it is a mere possibility; physical systems create the fiction of time by way of the arrangement of materials.

the human perspective; but the human perspective is a materially generated one. Therefore, motion —not as normally conceived in a quantitative sense of distance in time, but in a qualitative sense of change— is prior to time, too. qualitative motion can be illustrated, to some extent. For example, one can imagine erasing a penciled-in block on a sheet of graph paper, erasing it with one hand and penciling in an adjacent one with the other. For each x_1 & $x_2 \varepsilon M$, if one or the other is occupied, then *M* cannot logically be in either the states x_1 & x_2 or $\neg x_1$ & $\neg x_2$, where '¬' indicates not occupied. Against further charge of the eternalist and like-minded philosophers, that "surely the prior physical state gave rise to the present one," it must be admitted that time is being imposed artificially, because the setup has not yet (but will, through construction) admit time. Since the present, *M*, exists *in toto* at an instant, *sum ergo sum nunc*; these prior states are nowhere and nowhen —more importantly, nowhere—, and what is nowhere and nowhen is not. Of this second type of capacity, there are different kinds of change, not just a translational type, where a locale of occupation of hodons proceeds to adjacent hodons. To some, the idea of change possessing a taxonomy might seem unnatural, but it remains that '[c]hanges can come in different varieties.'[11]

Another type of change requires that, for heuristic purposes, one can imagine the physical space presented by hodons as being represented in mathematical space. This makes it easier to understand the second type of change, where hodons may collapse to the same relative position, as though two or more condense to a coordinate in the mathematical space, the hodons going from two distinct coordinates in the mathematical space, thus reducing the physical volume of available space. The mathematical space is only imaginary, used for the purpose of visualizing what is happening in physical space. There are a couple of cases in the "hodon-condensation"

[11] Mumford, Stephen. *Metaphysics: A Very Short Introduction*. New York City: Oxford University Press, 2012. p. 38

variety of change that need considering. For instance, two empty hodons may collapse to a single coordinate in mathematical space, but one may be filled. The latter case is one that, barring physical constraints imposed by the material system by way of laws, is perfectly admissible. The same goes for *both* of the condensing hodons being occupied. For our interests, what is of value is that these are all possible species within the variety of change currently being discussed. Something subtle has happened in the case of occupied hodons collapsing. It has been implied that space, on the level of hodons, may change the relative physical position of a state of occupation. This is the third type of change that shall be introduced. Before continuing a brief caveat lector is necessary. It should be noted that the condensation variety of change will be considered to occur locally, so far as the global manifold is concerned. One may think of this variety of change being so localized typically that it is on a par with background quantum fluctuations in space, though large-scale occurrences are certainly worthy of being discussed, possibly in the context of Big Bang cosmology.

The third type of change in this metaphysical taxonomy admits the possibility that a particular hodon may be occupied, yet, rather than translation occurring (and the particular hodon being occupied changing), the particular hodons may change orientation, as if to have changed relative position within the imagined mathematical space. It is trivial, for our purposes, that unoccupied hodons may do the same, changing relative orientation, because time arises through considerations of change that occur in relations between matter (an occupation state) and space; so while metaphysically significant, there doesn't seem to be a physical interpretation or understanding of empty hodons changing relative positions. Occupation of one or more of the hodons is what supplies physical significance. Embracing this taxonomy of change and this non-

quantitative conception of motion as something that happens in space but not time, the discussion shifts to the illusion of time and how it emerges.

Central to the thesis of this paper is the idea that time arises from a material system (an observer) that coordinates types of change. That is, the system has assumed into its structure somehow a mode for recording types of change, and then interpolates a qualitativeness, an extension (i.e., duration), and metricization occurs so as to provide a natural scaling ("pace") to the duration, which is based on the ratio of local to non-local changes. (Note: this distinction of "local" and "non-local" change will only make sense once we introduce physical systems that can coordinate internal, i.e., local, changes with information received from elsewhere that contains indication of changes, which would be non-local, i.e., come from without.) "Metricization" is used to denote an implicit process containing a ***convention*** for turning a qualitative extension into scaled, quantitative and paced, duration. The most natural way to explain the pace of time is to presume that there is some way for a system to compare a frequency of changes —not in time, but as a ratio of one type of change to another. One intuitive way to see that coordination of changes might be more than merely plausible is to consider the fact that a change is *capable* (i.e., qua capacity) of nothing more than casting an impression, like an elephant's footprint in mud. There is no extended aspect to events that are fully synopsized by an impression. This is where the problem of deriving durations from instants arises. The problem is quite a bit more complicated than the arguments for the possibility of spatial continua can accommodate.[12] One reason is that of the logical issues that arise, motivating temporal parts, briefly touched upon earlier. Another reason is that it is not intuitively clear how a transfinite number of changes (fundamental events) can occur to generate temporal extension. A quick

[12] Grunbaum, Adolf. "A Consistent Conception of the Extended Linear Continuum as an Aggregate of Unextended Elements."*Philosophy of Science* 19, no. 4 (October 1952): 288-306.

discussion of temporal continua so composed as Grünbaum's space, and why it is a problem, would be of value, before further discussing how time arises from the coordination of types of change.

There is a large philosophical contingent that supposes the problem of Zeno's Arrow Paradox has been resolved. In Aristotle's *Physics*, he says,

> The third [paradox] is … that the flying arrow is at rest, which result follows from the assumption that time is composed of moments … . He says that if everything when it occupies an equal space is at rest, and if that which is in locomotion is always in a now, the flying arrow is therefore motionless.[13]

There are two problems, one which Aristotle had in mind and addressed, the other he did not necessarily see. The problem he was addressing was the fact that instants seem to lack motion, by definition, and so it seems a matter of mere appearance, from Zeno's standpoint, that there is such a thing as motion —and the present paper defends Zeno, on this point. Aristotle supposed that the Arrow Paradox was only a paradox if there are instants or moments. He said, the Arrow Paradox 'results from the assumption that time is composed of moments: if this assumption is not granted, the conclusion will not follow.'[14] However, instants don't need to go. Huggett has proposed a slightly repackaged version of Wesley Salmon's 'at-at' theory of motion, which simply says that motion, as understood by basic physics, is composed of instants, wherein an object exists at a succession of coupled x-coordinate-t-coordinate pairs.[15] One problem with this is it doesn't explain where the motion goes in the instant.[16] For instance, one is lead to ask the

[13] Huggett, Nick. "Zeno's Paradoxes." Stanford Encyclopedia of Philosophy. http://plato.stanford.edu/entries/paradox-zeno/#Arr.
[14] Aristotle, . "Physics." In *The Complete Works of Aristotle*, Edited by Jonathan Barnes, 315-446. Translated by Benjamin Jowett. Princeton: Princeton University Press, 1995. p. 405 (239b.30)
[15] Huggett, Nick. *Space from Zeno to Einstein: Classic Readings with a Contemporary Commentary*. Cambridge: MIT Press, 1999. p. 50
[16] Barbour, Julian. *The End of Time: The Next Revolution in Physics*. New York City: Oxford University Press, 2000. Barbour's treatment could be seen as slightly more effective, in terms of expressing where the motion goes in

question, does the object in this individual instant possess kinetic energy? How could it, considering that instant alone? There is an additional problem posed by the Arrow Paradox that the at-at theory of motion doesn't explain: how is motion possible if points in continua do not have definite and discrete proximate points? This is the sockdolager. It seems that a fundamental bit of change is needed, in order to understand how it is that the arrow's point goes from one location to another, otherwise proximate points of zero extension must exist next to any point in a continuum. What can be said is that the location of the arrow's tip in the next instant is indefinite in a world structured within continua, spatially and temporally. The change in place, *per se*, is not an issue, but how one is to impose time upon the change is; and where to place the arrow's tip in the next instant is also in question. It is for this reason that it is conceivable to imagine an object changing position in space, effectively traveling, yet it is in reflection, asking "at what rate?," that problems occur. It is this line of thinking that further motivates developing a notion of time as constructed out of change, and coordination of change appears to provide a reasonable articulation as to how that may be.

Among the problems experienced by presentists is how it could be that instants, in any way, might assemble to create duration. One way, which has already been eliminated as unsatisfactory, is to suppose that, like space, duration (as extension) is a composite of transfinitely many unextended elements. Another —the novel method of construction in this paper— is for a physical system (i.e., a material arrangement in space) to possess the ability to be affected by the various modes of change, to discern between those modes of change, and coordinate them in ratios that determines how to interpolate temporal extension. (Note the reader: we are talking about memory, at this point.) The coordination would be between

each instant, though Barbour undermines the ontological status of time in his system. In it, Barbour maintains that the indicators of motion are contained in each "time capsule," entirely accounting for time spatially.

translation (the observed phenomenon) and the intra-observer changes which are made possibly by the two other classes of change in our metaphysical taxonomy of change. (Again, the former, external to an observing system, are simply called "local", the latter, internal to the observing system, are "non-local" for simplicity of reference in discussion.) Without the latter, an observer would be simply bombarded by a succession of unintelligible, uninterpretable instants. From within the context of Durie's discussion of the ancient Grecian debate on time, philosophers are misguided in commenting in such ways as to say, '[t]hat which would render time possible — either as discrete or continuous— finally renders it impossible,' because the ancient Greek perspective is thoroughly anthropocentric in perspective.[17] It is what makes time possible which makes it unreal; and so "possible" is not meant to have the ontological fecundity that so often accompanies metaphysical discussions of what is possible. This is what makes time such an intriguing topic: its possibility and actuality stand outside of what would typically be countenanced in metaphysics as truly "possible" or truly "actual," especially given the standards of this presentist framework. This is why it was possible to apply the word "convention" earlier, in describing the scaling of a qualitative extension, turning the interpolated qualitative extension into what is understood to be time. What is objective is the ratio of the number of changes outside of the observer to the number of changes internal to the observing system. The details of how exactly a material system coordinates and discerns between changes is likely a very complicated affair, arguably one that falls within the realm of the sciences more than philosophy.

Rather than develop a detailed metaphysical account of precisely how time is constructed out of changes, because of space constraints in this forum, what has been done is to reframe the presentist framework, acknowledge its shortcomings and the shortcomings of non-presentist

[17] Durie, Robin. "The Strange Nature of the Instant." In *Time and Instant: Essays in the Physics and Philosophy of Time*, edited by Robin Durie, 1-24. Manchester: Clinamen Press, 2000. p. 19

philosophies of time, and bring the metaphysical discussion to a head, where something within ontology might point to the correctness of this metaphysical framework that lays out the nature of physical space. That piece of evidence affirming that something very, very like the above-described setup lends strength in corroboration. We find such evidence in the special theory of relativity, where the observers in different inertial reference frames disagree as to the pace of time in one another's clocks.

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