

# **Temporal holism**

John Michael Pemberton<sup>1</sup>

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# Abstract

How can a persisting object change whilst remaining the same object? Lewis, who frames this as the problem of temporary intrinsics, presents us with the perdurance solution: objects persist by having temporal parts which may have differing properties. And in doing so he characterises the opposing view as persisting but not by having temporal parts - a view he calls endurance. But this dichotomous picture of Lewis, although now widely embraced, misses out the orthodox historic view - a view I call temporal holism: objects persist by having temporal parts to which they are ontologically prior. (In the perduring solution, by contrast, the temporal parts are ontologically prior.) This paper sets out this temporal holist solution and makes clear its differences from perdurantist and endurantist solutions. Although temporal holism has a long and illustrious history, this history has not been explicitly recognised. I begin the task of recognising this history in this paper, in order to make clear the nature of temporal holism, and to show that it is a long-established, well supported and distinctive position. The paper sets out, too, how temporal holism solves other ontological problems so that, despite its current neglect, temporary holism has the potential to greatly enrich contemporary philosophical debates.

Keywords Temporal part  $\cdot$  Holism  $\cdot$  Substratum thesis  $\cdot$  Aristotle  $\cdot$  Atomism  $\cdot$  Ontology  $\cdot$  Mosaic  $\cdot$  Lewis  $\cdot$  Perdurance  $\cdot$  Endurance  $\cdot$  Persisting object

# **1** Introduction

How can a persisting object change whilst remaining the same object? Lewis, who frames this as the problem of temporary intrinsics, presents us with the perdurance solution: objects persist by having temporal parts which may have differing properties. And in doing so he characterises the opposing view as persisting but not by having temporal parts—a view he calls endurance. But this dichotomous picture of Lewis, although now widely embraced, misses out the orthodox historic view, I

John Michael Pemberton johnpemberton.london@outlook.com

<sup>&</sup>lt;sup>1</sup> Department of Philosophy, Durham University, 50 Old Elvet, Durham DH1 3HN, UK

argue—a view I shall call *temporal holism* (TH): objects persist by having temporal parts to which they are ontologically prior. TH solves the problem of changeable persisting objects (the problem of temporary intrinsics) in a similar way to perdurantism: persisting objects have temporal parts that may differ. TH differs from perdurantism, as I explain in Sect. 2, in that persisting objects are prior to their temporal parts, whereas in perdurantism the parts are ontological prior to the persisting object. TH differs from endurantism, as I explain in Sect. 3, on the issue of whether persisting objects have temporal parts.

To show how this temporal holist solution goes in practice, I look at some historic examples (in Sects. 4 and 5). History provides us with a plethora of diverse temporal holist ontologies - leading ontologies from across the ages that we know from our standard philosophical learning. TH accords with an Aristotelian idea of a natural ontology of fundamental ordinary objects accessible to our commonsense perception that exist through time. It accords too, in a somewhat different way, with atomist ontologies in which atoms are deemed indestructible. Moreover, it accords with intuitions that nothing comes from nothing-that something (some substratum) must exist through change—an intuition which, as Pasnau notes,<sup>1</sup> dominated beliefs from Aristotle through to the seventeenth century, and which is still today comprehensible and receiving of support. The distinctive characteristic of TH ontologies, fundamental objects that exist through time, is perhaps brought into sharpest relief by contrast with contemporary mosaicism, a world of point-in-time fundamental objects such as that of Lewis and other neo-Humeans (as I discuss in Sect. 2). Although TH has, then, a long and illustrious history, this history has not been explicitly recognised—I begin the task of recognising this history here.

In order to clarify the nature of TH, I offer explicit consideration of how temporal parts are unified into one whole, e.g. by a substantial form or by causal principles, in Sects. 6. And I set out other strong ontological attractions of TH, aside from solving the problem of changeable persisting objects (the problem of temporary intrinsics), in Sect. 7. Section 8 sketches Jonathan Lowe's support for temporal holism. Section 9 concludes that TH not only solves the problem of changeable persisting objects, but is also a long-established, well supported and distinctive position that can solve other ontological problems. TH, despite its current neglect, could greatly enrich contemporary philosophical debates.

### 2 Perdurantism vs temporal holism

A leading view within contemporary philosophy holds that the world comprises a mosaic of instantaneous spatio-temporal tiles. An example of such a view is that of the neo-Humeans which David Lewis expresses as follows:

'All there is to the world is a vast mosaic of local matters of fact, just one little thing and then another ... We have a geometry: a system of external relations of spatiotemporal distances between points ... And at those points we

<sup>&</sup>lt;sup>1</sup> Pasnau 2011 – see Sect. 5.

have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated. For short: we have an arrangement of qualities. And that is all.<sup>2</sup>

Amongst the neo-Humeans there are differing flavours of mosaicism. For example, we find different accounts of properties (e.g. instantiated universals, tropes) and how these properties get together (e.g. simple co-location, bundling); and different accounts of the tiles—e.g. as 'states' or 'events'.<sup>3</sup> Mosaicist ideas can arguably be traced to Plato's account of the Receptacle within the Timaeus.<sup>4</sup>

Mosaicists do, of course, posit the existence of concrete things which persist through time within their ontologies. On the mosaicist account, these are pluralities of adjacent and sufficiently similar tiles. Bertrand Russell, for example, takes a 'common-sense' thing to be a dense infinity of adjacent events which exhibit 'quasi permanence', i.e. suitable similarity relations: each tile may differ a little from its neighbours but not too much—the commonsense thing (the plurality of adjacent tiles) then exhibits gradual change.<sup>5</sup> According to mosaicist ontologies, then, the entities which form the mosaic's instantaneous tiles are the fundamental building blocks of the ontology, so that persisting concrete things are derivative entities built from such fundamental tiles.

David Lewis adopted the term '*perdurance*' to describe the persistence of such objects within such ontologies: a perduring object has a temporal part at each time at which it exists.<sup>6</sup> As we have noted, perdurantism solves the problem of change in persisting objects by allowing that each of these temporal parts may have differing properties.

TH solves the problem of changeable persisting objects in a similar way: it posits temporal parts which can differ from each other. I shall illustrate how, in TH ontologies, temporal parts may differ in the context of specific historic accounts below.

In contrast to temporal holism which takes a persisting object to be ontologically prior<sup>7</sup> to its temporal parts, mosaicism supposes that the instantaneous temporal parts (the tiles) are fundamental and hence ontologically prior to the persisting object as a whole. Temporal holism and mosaicism thus differ on whether the temporal whole or parts are ontologically prior – they are distinct alternative accounts of persisting objects.

<sup>&</sup>lt;sup>2</sup> Lewis, (1986a), (1986b), ix.

<sup>&</sup>lt;sup>3</sup> 'An "event" may be defined as a complete bundle of compresent qualities' (Russell, 1948, p. 78).

 $<sup>^4</sup>$  Especially on spatial, as opposed to material, accounts of the Receptacle – see e.g. Zeyl and Sattler (2022), Sect. 6.

<sup>&</sup>lt;sup>5</sup> Russell (1948), pp. 429–30.

<sup>&</sup>lt;sup>6</sup> See e.g. Lewis (1986a), Sider (2001).

<sup>&</sup>lt;sup>7</sup> Whilst the ontological priority of temporal parts vs temporal wholes is a matter often left implicit within discussion of persisting, a handful of authors have recently discussed this issue explicitly – see for example Valerio Buonomo (Buonomo, 2018, chapter 2, especially Sect. 2.2) and Jeremy Skrzypek (Skrzypek 2022).

### 3 Endurantism vs temporal holism

Before the introduction of the term 'perdure' in its current Lewisian sense, 'endure' was typically used with a folk meaning of roughly surviving/existing through change/time.<sup>8</sup> However, since the work of David Lewis and other perdurantists, the term as it is commonly used within philosophy, has widely taken on additional connotations that it did not previously have. The connotation with which I am concerned is as the correlate of the term 'perdure'. In presentations of the case for perdurance, we often find that the (only) alternative to perdurance that is on offer is endurance, so that 'enduring' is then understood as meaning (as Ryan Wasserman suggests<sup>9</sup>) something like 'persisting but not by perduring' or 'persisting but not by having temporal parts'. This negative characterisation is often glossed with the seemingly more positive suggestion that enduring entails being 'wholly present' at each time of its existence). Unfortunately, many commentators find the meaning of the term 'wholly present' to be unclear.<sup>10</sup>

In any case, it seems that there is a strong consensus for the view that endurantism does entail at least this much: that persisting objects do not have temporal parts. This lack of temporal parts is the principal basis for the perdurantist's complaint that the endurantist position cannot account for change in persisting objects: if the persisting object does not have differing parts, then it cannot have differing properties at differing times. Endurantists reject this claim, of course, offering a number of accounts, such as time-indexed properties, which license differing properties at differing times.

As endurantism does then, on the standard view, entail that persisting objects do not have temporal parts, it differs from TH which supposes that they do have temporal parts.

# 4 Aristotle's temporal holism

I start with Aristotle in my consideration of historic temporal holist ontologies as Aristotle not only sets out a rich and careful account of change and time, he also articulates and argues for the thesis that there is always a substratum that exists through any change. I follow Robert Pasnau in calling this the Substratum Thesis (ST).<sup>11</sup> On Aristotle's account, as I shall show, the unity through change of the substratum (as per ST) of a persisting object, underwrites the unity through change of the persisting object itself, and hence its unity through time. This unity through time of persisting objects is what I take to be temporal holism.

<sup>&</sup>lt;sup>8</sup> See for example Pasnau (2011), e.g. pages 26.

<sup>&</sup>lt;sup>9</sup> Wasserman, (2016), 247.

<sup>&</sup>lt;sup>10</sup> See for example Sider (2001), 68; McCall and Lowe, (2006), pp. 571–572.

<sup>&</sup>lt;sup>11</sup> Pasnau, (2011), page 18.

#### 4.1 The substratum thesis

The problem of how persisting objects could change but remain the same was a topic of concern for many of Aristotle's predecessors. Aristotle renders an aporia handed down from Parmenides and the Eleatics thus: '*nothing comes to be or passes away, because whatever comes to be must do so either out of something which is, or out of something which is not, and neither is possible*'.<sup>12</sup> If P comes from P, then we do not have change. To have change, P must come from the privation of P,  $\neg$ P. A widespread concern amongst the ancients, such as Parmenides, was that change (the becoming of P from  $\neg$ P) must imply the passage from not-being to being. It was generally agreed, including by Aristotle,<sup>13</sup> that such passage from not-being to being - i.e. creation ex nihilo – should be rejected. Such considerations led Parmenides to reject the very possibility of change.

Aristotle by contrast, in developing an ontology that is adequate for natural science, seeks to establish the reality of change, not to reject it. In order to address the threat of creation ex nihilo, of P coming from  $\neg$ P tout court, Aristotle posits an underlying substratum of change that exists throughout the process of change from P to  $\neg$ P—the substratum thesis.<sup>14</sup>

Substantial change (in which a substance comes into being or ceases to be) is generally regarded to be the more difficult case for establishing a substratum that exists through change. The substratum here is typically taken to be some form of matter, often prime matter. The nature of such matter is an issue lying at the heart of Aristotle's ontology that continues to be extensively debated and remains highly controversial.<sup>15</sup>

For our purposes here it is the case of accidental change that is in focus. In this case it is a persisting object, such as a substance or artefact, that undergoes change: it comes to have certain forms, certain accidental properties, which it did not have previously. For example a musical person comes to be from an unmusical person.<sup>16</sup> The substratum that Aristotle posits exists – exists as some one thing – through the change and in doing so underwrites the existence (as someone thing) through change of the substance. Aristotle makes clear that the substratum ensures the existence of the persisting object through change in presenting the substratum thesis as the solution to the threat of creation ex nihilo: each stage of the change of the substance (e.g. the musical person) comes to be from the previous stage, it is not a new replacement that comes from nothing. Moreover, the gaining or losing of accidental properties (e.g. musicality) at each stage does not threaten this continuing existence through change.

There is much that could be said, and much controversy, concerning aspects of Aristotle's account of change, but as my interest for the purposes of this paper is just

<sup>&</sup>lt;sup>12</sup> Aristotle, Physics, I.8, 191a25-28. For a history of the problem of being coming from not being in Ancient Greek thought see Sattler 2020 – especially pages 280–282 for Aristotle's solution.

<sup>&</sup>lt;sup>13</sup> 'Now we agree that nothing comes in an unqualified sense from what is not.' Physics, I.8, 191a25-28.

<sup>&</sup>lt;sup>14</sup> Physics I.4, 187a27-29, Metaphysics XI.6 1062b23-24, Metaphysics VII.7 1032b30-1033a1.

<sup>&</sup>lt;sup>15</sup> See for example Pasnau, (2011), Part1.

<sup>&</sup>lt;sup>16</sup> Aristotle, Physics I.7–8.

the existence through change of the persisting object, I shall not venture further here into such related matters.

#### 4.2 Temporal parts

Aristotle takes change to be prior to time.<sup>17</sup> As we have noted, persisting objects such as substances may change on Aristotle's account – for example they may change from being in privation of some form to having that form (perhaps on account of a period of contact with some correlate agent). We may pay selective attention to how the object is at each stage of change (e.g. the stage of its having a form or the stage of its being in privation of that form) – and in this sense we may abstract<sup>18</sup> the object's stages of change (e.g. the unmusical person, the musical person).

As Ursula Coope explains, we may on Aristotle's account ascribe numbers to stages of change and take these numbers to be time: time, then, is the number of change in respect of the before and after.<sup>19</sup> In ascribing such numbers to the stages of change we may, then, reasonably adopt contemporary parlance and call them 'temporal parts'. A temporal part of a persisting object is then simply that persisting object over some period of time, which we may abstract from the persisting object by selective consideration of the object during that time. In adopting this jejune notion of temporal part, I follow an approach of Jonathan Lowe, as I discuss in Sect. 8.<sup>20</sup>

In order to make more precise this notion of temporal part, we must address the issue of point-in-time parts. On this simple account, a point-in-time part is just the persisting object at a single point in time – a temporal part with zero duration. We may abstract such a point-in-time part by selective consideration in just the same way as we abstract any temporal part that exists for a (non-zero) period of time. Consideration of how we treat such point-in-time parts is required as Aristotle denies that a point is a part of a line or, correlatively, that a now (a point in time) is a part of time,<sup>21</sup> so that Aristotle would not accept a point-in-time abstraction from the object – i.e. a point-in-time 'part' – to be a part of an object.

However, the view of many contemporary commentators differs from Aristotle on this issue. Consideration of developments in mathematics are now widely taken to support the view that points are parts of a line. The mathematical view here follows in large part from the development of Real numbers: a Real number interval (e.g. the interval from 0 to 1: [0, 1]) may be regarded as a set of all the numbers in that interval – so that each of these Real numbers is then a part of that set.<sup>22</sup> The development of this view is supported by advances in the treatment of infinities that distinguish countable from uncountable magnitudes – and is closely linked to advances in the

<sup>&</sup>lt;sup>17</sup> Coope (2005).

 $<sup>^{18}</sup>$  Abstraction may be understood as involving the paying of selective attention to certain aspects – see e.g. Bäck (2014).

<sup>&</sup>lt;sup>19</sup> Physics IV.10–14, Coope (2005).

<sup>&</sup>lt;sup>20</sup> Jonathan Lowe adopts just such a notion of temporal part in Lowe (2006), page 724.

<sup>&</sup>lt;sup>21</sup> Aristotle, Physics VI.9 239b6-8

<sup>&</sup>lt;sup>22</sup> See for example Stillwell (2016).

mathematical treatment of continuity, and hence to the differential calculus, over the past two centuries by, inter alia, Cauchy and Weierstrass.<sup>23</sup> These developments, then, underwrite key successful applications of mathematics – especially the differential calculus—and are at the core of orthodox contemporary methods.

As I do not wish to adopt a view that risks conflict with orthodox contemporary mathematics, I shall allow for the purposes of discussion here, contra Aristotle, the admission of point-in-time parts. Such acceptance of point-in-time parts accords, of course, with the view of neo-Humeans, as is apparent in our discussion of Lewis point-in-time mosaic above.

Note that rejecting point-in-time parts, as does Aristotle, would seem to provide a short-cut to rejecting the mosaicist position (such as that of Lewis) that a persisting object is composed of point in time entities, for there are then no point-in-time parts to be composed. Accepting point-in-time parts as I do here, eschews this shortcut and licenses a focus on other relevant ontological considerations.

#### 4.3 Aristotle is a temporal holist

Section 4.1 argued by reference to the substratum thesis that persisting objects exist (as some one thing) through change on Aristotle's account – they are unities with respect to their stages of change. Adopting Aristotle's account of time so as to identify these stages of change as temporal parts, means that we recognise persisting objects as unities with respect to such temporal parts. It is in this straightforward sense that I take Aristotle to be a temporal holist.

### 4.4 Further aspects of Aristotle's ontology that accord with temporal holism

To show that Aristotle embraced TH broadly throughout his account of ontology, I will briefly note some further aspects of Aristotle's ontology that accord with temporal holism but not with ascribing ontological priority to temporal parts:

- 1. Substances within the superlunary sphere, such as stars, are explicitly eternal, on Aristotle's account and such eternality is a source of perfection. Such perfect beings are surely unities on Aristotle's account they are not merely (temporal) heaps built from ontologically prior temporal parts (that stretch out throughout all time).
- 2. Substances in the sublunary sphere, such as animals, cannot attain eternality by themselves but by reproducing they can, on Aristotle's account, ensure the eternality of their species. The degree of perfection achieved in respect of eternality by species on account of reproduction is of a lesser degree than that attained by eternal superlunary substances reflecting the fact that this is only a kind of approximation to eternality.<sup>24</sup> Individual substances obtain over some period

<sup>&</sup>lt;sup>23</sup> See for example Edwards, (1979), pp. 301–334: *The calculus according to Cauchy, Riemann, and Weierstrass.* See also Pemberton (2023), pp 30–31.

<sup>&</sup>lt;sup>24</sup> Aristotle, On the soul, II.4, 415b2-8.

of time so as to collectively achieve eternality. If reproductive substances were themselves composed of temporal parts, it seems the degree of approximation to eternality of the species would be considerably lower – especially if there were infinitely many such parts (i.e. instantaneous parts).

- 3. Substances, on Aristotle's account, have *natures*, i.e. internal principles of change and rest.<sup>25</sup> If a substance were not a temporal unity, but rather a composite of ontologically prior parts, then each substance would have plural natures (at least one for each temporal part) and this would be inconsistent with Aristotle's account: there is no reference to such a plurality of natures.
- 4. Substances qua agents and patients are teleological beings, according to Aristotle: they act / are acted upon over time, where this acting over time of the agent is towards some telos (the transmission of a form from the agent to the patient). This too seems inconsistent with agent / patients having distinct temporal parts each with its own distinct teleology: this would seem to preclude a substance at some time acting towards an end which will obtain after the end of the temporal stage of the substance which then obtains.

Note that in each of these cases a major problem with positing extended temporal parts (that is temporal parts that are not instantaneous but rather obtain over some non-zero period of time) would be specifying what these parts are. We might, for example, choose such temporal parts to be first half / second half, or the sequential quarters, or some other of the infinity of possibilities. But what principled basis might we have for choosing any particular one of these infinity of partitioning options? Choosing any specific partition (say first-half, second-half) reveals the intuitive implausibility of such a view: a horse is really 2 separate half-horses which exist one after the other. The problem of choosing a seemingly arbitrary partition could be avoided by opting for point-in-time temporal parts (like the mosaicists) - there is then just one such partition of the time interval: the partition into the dense infinity of points that we label with Real numbers (which for the purposes of our consideration we are, contra Aristotle, allowing here). But introducing a dense infinity of separate parts seems even less in keeping with Aristotle's account on each of the four consideration we have identified. For example, it seems even less compatible with ascribing a degree of perfection associated with eternality to a sublunary substance (in 2). And a principle of change and rest, a nature, would seem to have no useful meaning in relation to an entity that exists for a single instant as an entity that exists at a single instant cannot change (in 3).

These aspects of Aristotle's ontology lend support, then, to the view that he is a temporal holist. Certainly I am unaware of any commentators who have argued in favour of the view that Aristotle did posit distinct fundamental temporal parts of substances.

<sup>&</sup>lt;sup>25</sup> See e.g., Waterlow 1982.

# 5 Temporal holism following Aristotle

As scholastic Aristotelianism dominated western philosophical discourse through the medieval period, so Aristotle's temporal holism remained the orthodox position. Robert Pasnau in his history of the fourteenth to seventeenth century<sup>26</sup> explores philosophical trends in this period during which the long-standing dominance of Aristotelian thinking declined to give way to the new ideas of early modern philosophers following the Scientific Revolution. Commitment to the Substratum Thesis remained almost universal during this period – Pasnau describes the degree of consensus in favour of ST as 'remarkable', commenting that in his research of the period '*I have found no one who rejects the substratum thesis*'.<sup>27</sup> Moreover, the commitment to ST generally followed – as it did for Aristotle—from the rejection of the possibility of creation ex nihil (except by God).<sup>28</sup> As we might expect, these commitments to ST underwrote a commitment to temporal holism,<sup>29</sup> as they did for Aristotle, albeit with modifications in the nature of that temporal holism.

Pasnau identifies a major trend through this period to be the increasing physicalisation of the parts of substances, with a greater focus on integral parts, accompanied by a corresponding decline in support for metaphysical parts, most notably substantial forms. It was thus increasingly physical parts which underwrote the existence of persisting objects through change. For many commentators, such as Robert Boyle, there was a reversion back to positions more or less closely related to the ancient atomism of Democritus. On Democritus's account, atoms, the fundamental physical beings, are indestructible and immutable so that they survive through time – and hence they underwrite temporal holism at the fundamental level. Composite objects of experience, such as artefacts, are derivative: they are arrangements of atoms in motion that change as their arrangement changes. When a composite survives over some period, it survives as the continuously changing arrangement of its atoms – and hence as a unity through time. Such atomism is, then, temporal holist.

Descartes follows a different path to the physicalisation of parts in taking *body*, to which he ascribes the key attribute of extension, to be the indestructible physical feature that survives through change. Unlike the Atomists, Descartes supposes that matter may be divided indefinitely, so that there is no smallest part. On account of his commitment to body as a surviving substratum, Descartes too is a temporal holist.

TH, then, largely survived the transition from Aristotelian thinking into early modern philosophy. The rejection of TH largely occurs later with the rejection of necessary connections between distinct existences that arose in the light of Humean inspired scepticism concerning causation.

<sup>&</sup>lt;sup>26</sup> Pasnau (2011).

<sup>&</sup>lt;sup>27</sup> Pasnau, (2011), 20.

<sup>&</sup>lt;sup>28</sup> Ibid, 20.

<sup>&</sup>lt;sup>29</sup> I suppose for ontologies quite generally that a temporal part of a persisting object is simply that persisting object at some time, or over some period of time (a part obtained by abstraction, i.e. by paying selective attention to the persisting object at that time).

### 6 The nature of temporal holist ontologies

To explore the nature of temporal holist ontologies, it is helpful to characterise TH somewhat more precisely than hitherto. I take a temporal holist ontology to be one in which a persisting object:

- 1. Is physical (so that it exists in space and time);
- 2. Exists for some period of time<sup>30</sup>;
- 3. Is ontologically prior to its temporal parts.

This characterisation makes transparent that the distinctive feature of a temporal holist ontology is the ontological priority of a persisting object with respect to its temporal parts, point 3. Let's, therefore, consider the nature of such ontological priority. I take it that a persisting object has ontological priority with respect to its temporal parts just when it has some principle of unity that underwrites this priority – such unity ensures that the whole is not just a composite or heap of temporal parts, but some one thing. As we have noted, temporal parts may be abstracted (by selective attention) from this one thing.

An obvious first move is to look for such principles of unity in historic accounts of temporal holist ontologies. And given his influence, Aristotle is a natural first candidate.

Aristotle's ontology offers several examples of wholes which are prior to their parts, perhaps most notably substances. Here, of course, we are broaching questions associated with hylomorphic unity – a topic that has long been hotly debated and continues to be so. Whilst commentators generally agree that a substantial form unifies substances, there is a complex web of views as to how this is achieved (e.g. by way of an operation that is either metaphysical or causal, or through the form as a unifying part).<sup>31</sup> There are, though, good reasons for supposing that answering such questions concerning substantial unity – even if possible – would not provide an immediate answer to the question of the unity of temporal parts of persisting objects.

Firstly, there may, on Aristotle's account, be elemental matter that is not enformed. A lump of mud or clay, for example, may be neither a substance nor a sum (e.g. a bundle or heap) of substances. If this is so, then the unity of the temporal parts of a lump of clay, or perhaps a particle of Earth, cannot be secured by a substantial form – there is no form in view to do the unifying. If the temporal parts of a substance are unified (in some way) by the substantial form, then, it would seem we must have (at least) two distinct ways in which the unity of persisting objects with respect to their temporal parts is achieved – one for substances (i.e. by the form) and one for non-substances, such as (heaps of) elemental matter.

Secondly, even if the unity of the temporal parts of a substance is achieved within the broader achievement of unity of the substance by a form, it does not seem safe

<sup>&</sup>lt;sup>30</sup> That is to say, if the persisting object L exists at time t, then it exists for some period that contains t, i.e. L exists at  $t \Rightarrow \exists T_0, T_1$  such that  $T_0 \leq t, T_1 \geq t, T_0 < T_1$  and L exists  $\forall t \in [T_0, T_1]$ .

<sup>&</sup>lt;sup>31</sup> See for example Scaltsas (1994), Koons (2014), Evnine (2016), Peterson (2018), Marmodoro (2020), Simpson (2023).

to assume that this is achieved in the same way as the unity of the spatial parts or metaphysical parts. Spatial parts may be taken to include what differing accounts call functional or integral parts. Temporal parts can play no role which is comparable with the functional role ascribed to functional parts, e.g. the role of the heart to pump blood within the body. Nor, I suggest, does the issue of whether a part can retain its identity outside of a substance apply to temporal parts in the same way as to integral parts – e.g. whether a heart or a chemical molecule that are parts of a body could continue to be that heart or that chemical molecule if removed from the body. Temporal parts would seem yet more different from metaphysical parts, such as form and matter – so that the form of unity of temporal and metaphysical parts may also be very different. So it seems possible, and perhaps likely, that temporal parts are unified by a form in different ways from spatial or metaphysical parts. On my reading the question of how temporal parts ae united is not explicitly addressed by Aristotle, nor indeed is it much addressed within the secondary literature – so the ideas we may draw from this area seem limited.

We may, though, identify a number possible ways in which the unity of a persisting object with respect to its temporal parts is achieved – here are some of these ways:

- Formal unity. In our brief discussion of Aristotle's TH just above, we noted the possibility that in the case of substances, a substantial form may play the role of (or perhaps a role in) unifying the temporal parts into a temporal whole, as well as perhaps unifying metaphysical parts (such as form and matter) and spatial parts (such as integral or functional parts). I noted briefly the marked differences between the differing kinds of parts which may be posited, and hence the complex considerations in explicating this unifying role of the form and perhaps how it differs between differing types of parts. Let's call any unity of the temporal parts that can be ascribed to a substantial form 'formal unity'.
- Brute unity: Perhaps the temporal unity of persisting objects is brute: they exist through time and are ontologically prior to their temporal parts, and this is simply a brute fact about the nature of the world. One refinement of this possibility is that there are certain building blocks of the world's physical ontology which have such brute temporal unity, and this temporal unity of the building blocks underwrites the temporal unity of composites. (This might perhaps be the view of atomists.)
- Teleological unity:<sup>32</sup> Perhaps the grounds of the temporal unity of some or all persisting objects may be associated with the teleological character of these entities in some way. As we have noted in discussion of Aristotle position, for an entity to act teleologically (e.g. to act to bring about some end (telos)), it would seem necessary for that entity to obtain over some period during which it undertakes a series of suitable intentional acts. As well as human intentionality as a model for such teleology, the functional roles of entities taken to be mechanical

<sup>&</sup>lt;sup>32</sup> I.e. unity achieved by reference to some telos (i.e. some end or purpose). For discussion of teleology see Tugby (2024). And for discussion of Aristotle's teleology see Johnson (2005).

(perhaps ones of the sort posited by the new mechanists<sup>33</sup>) might provide a basis for such unity.

- Causal unity: Perhaps the temporal unity of persisting objects might be underwritten by some form of causal influence between their temporal stages: e.g. later stages are caused in some suitable way by earlier stages, where what it is to be 'suitably caused' is defined by the putative account of causal unity. Any such causal account would need to ensure that such causal unity underwrites the ontological priority of the persisting whole over its temporal parts. (Such an account of causal unity might resonate with a notion of 'conatus' such as that of Spinoza<sup>34</sup>).
- Continuity-based unity: Perhaps the temporal unity of persisting objects might be underwritten by some form of continuity across stages where the continuity posited is such as to ensure the ontological priority of the persisting whole over its temporal parts. (Such a continuity account of unity might resonate with 'genidentity' accounts of unity,<sup>35</sup> perhaps appealing to causal influence as well as continuity. Note, though that genidentity accounts, on my reading, generally make no commitment to the ontological priority of either temporal wholes or their parts.)
- Sui generis unity. Perhaps the temporal unity of entities that we find in the world is not brute, but rather is explicable according to some sui generis account yet to be discovered.

Each of these ways of achieving unity is likely to have major implications for the nature of the ontology in focus, so that this wide range of possible ways of unifying temporal parts suggest a diversity of possible temporal holist accounts of ontology. And this wide range of accounts offers hope for finding attractive ontologies amongst their number – ones which provide new solutions to the ontological challenges which we, as philosophers, are seeking to tackle. Let's, then, consider briefly some strengths of TH ontologies.

# 7 Attractions of temporal holist ontologies

Mosaicism, in its various forms, has undoubtedly become a highly popular ontological view within contemporary philosophy. The work of David Lewis in showing how his version of mosaicism is a plausible account of the ontology of the world that solves a very wide range of metaphysical challenges, has certainly been one influence supporting this popularity. Moreover, such neo-Humean positions are widely taken to provide a good account of the natural / physical world – a qualification for an account of ontology that is highly rated by many commentators.

Still, David Lewis recognises explicitly that arguments of the kind he advances can only show the plausibility of his favoured account – not that this account must

<sup>&</sup>lt;sup>33</sup> See for example Bechtel & Abrahamsen (2005); Craver (2013).

<sup>&</sup>lt;sup>34</sup> Spinoza (1996), especially part III, prop 6.

<sup>&</sup>lt;sup>35</sup> See for example Guay and Pradeu (2016).

be true. Recent years have seen the revival and development of neo-Aristotelian ideas in areas such as modal logic, causation and powers spurred in part by a drive to capture more accurately, so it proponents believe, an ontology which captures the natural world, including the holisms of the quantum domain, more successfully than do neo-Humean views.<sup>36</sup> I read such neo-Aristotelian views, insofar as they support persisting Aristotelian substances, as being consistent with temporal holism. If this is so, we currently have a live on-going debate concerning the relative attractions of ontologies some of which are temporal holist, and others of which are not.

As we have noted, TH, like perdurantism, posits temporal parts as the solution to the problem of changeable persisting objects. We saw in the case of Aristotle's ontology how differing temporal parts (e.g. the unmusical man, the musical man) may have differing properties (e.g. musicality or lack of musicality). In the case of atomism, change in composite persisting objects is underwritten by changes in the arrangement and motion of composing atoms – there are no entities in view that we might call 'properties' that may attach or not to persisting objects. Temporal parts (which we may abstract from the changing composite) may differ at differing times on account of differences in atomic arrangement and motion. In either the Aristotelian or atomist case, temporal parts may differ hence underwriting the change of persisting objects. In general I take it that the ontological dependency of temporal parts on a persisting object as a whole is no bar to these parts differing, so that TH, like perdurantism, licenses change in persisting objects.

Temporal holism, then, matches the perdurantist solution to the problem of changeable persisting objects. But the temporal holist may argue that its account of persisting objects is stronger than that of mosaicism: the unity of the temporal parts of a persisting object is underwritten directly by the ontology – this is the distinguishing characteristic of TH. On the mosaicist account, by contrast, necessary connections between distinct existences, and hence temporal parts, are proscribed: we simply have a set of mosaic tiles that are contiguous and sufficiently similar. What is it that makes these tiles into a persisting object rather than simply a set of different point-in-time objects? I shall not here argue against the Humean answer. But it is certainly open to the temporal holist to argue that this is a less strong position than their own. Whatever the outcome of this debate, TH matches the perdurantist solution in respect of the having of temporal parts which may differ, and hence does avoid the key criticisms to which the endurantist is liable.

Here are two further advantages of TH that I argue for in my earlier work.<sup>37</sup>

Firstly, TH licenses the possibility instantaneous velocity at the fundamental level: an object that exists over some period of time, provided that it has a suitably continuous trajectory of spatial positions, can be ascribed a velocity. By contrast, velocity is eliminated at the fundamental level in the mosaicist picture: an object which exists for a single point in time cannot meaningfully be ascribed a velocity (at least, not if 'velocity' has its usual meaning related to changing of position). Note that the elimination of velocity from fundamental ontology is generally acknowledged and embraced by mosaicists – as Russell expresses it: '*[W]e must entirely* 

 $<sup>\</sup>overline{^{36}}$  See for example Koons (2020); Simpson et al., (2018).

<sup>&</sup>lt;sup>37</sup> See Pemberton (2022), Pemberton (2022a), Pemberton (2023).

reject the notion of a state of motion. Motion consists merely in the occupation of different places at different times, subject to continuity as explained in Part V. There is no transition from place to place, no consecutive moment or consecutive position, no such thing as velocity except in the sense of a real number which is the limit of a certain set of quotients.<sup>38</sup> Russell is here advancing the 'at-at' account of motion. However, eliminating velocity from fundamental ontology is recognised as a serious problem by many philosophers, inter alia in undermining the causal role of the momentum of objects in collisions.<sup>39</sup> If these concerns are well-founded, then the admission of velocities counts in favour of temporal holist ontologies.<sup>40</sup>

Secondly, TH has advantages for the growing and increasingly influential school of philosophers that embrace powers. A powerist that adopts mosaicism (as most currently do on my reading) seems constrained to suppose that a power that operates at the fundamental level manifests when it is in a suitable point in time state (e.g. compresent with other mutual manifestation partners) and that the manifestation is then a new point-in-time state. (After all, there are only point-in-time states in the fundamental mosaic.) There are no successors in continuous time (as Russell notes<sup>41</sup>), so there must be a time gap between these two states - and the manifestation must jump over this period. Such a jump seems problematic.<sup>42</sup> Moreover, powers that manifest through time to bring about changing through time, like Aristotle's agent-patient powers, are excluded from such an ontology (where the manifestation is triggered at a single point in time). On standard accounts of physics, the fundamental forces (such as gravitational or electrostatic forces) are just such powers: they attract or repel continuously through time - they do not underwrite a jump from a state at one time to a later state. So the mosaicist powerists faces problematic leaps of manifestation across time and cannot capture either Aristotelian or standard fundamental physical powers. TH, by positing power-bearer that are unities with respect to their temporal parts, may avoid such problems: it may license powers (such as gravitational attraction) that can manifest over time to bring about changing (e.g. accelerating) over time.<sup>43</sup>

#### 8 Jonathan Lowe's temporal holism

Having read this paper, it may have occurred to some readers familiar with the work of Jonthan Lowe, that Lowe does in fact advocate a temporal holist position. Lowe claims:

<sup>&</sup>lt;sup>38</sup> Russell (2010), p. 480.

<sup>&</sup>lt;sup>39</sup> See, for example, Bigelow and Pargetter (1989), pp. 289–295; Tooley (1998), pp. 225–227; Arntzenius (2000), pp. 189–90; Carroll (2002), pp. 49–51; Lange (2005), pp. 436–442.

<sup>&</sup>lt;sup>40</sup> See also Pemberton (2023), chapter 5.

<sup>&</sup>lt;sup>41</sup> Russell (1913).

<sup>&</sup>lt;sup>42</sup> For a much fuller account of this no successor problem see Pemberton (2022).

<sup>&</sup>lt;sup>43</sup> I set out further arguments in favour of ontologies that license powers with 'Aristotelian timing' such as the fundamental forces of physics in Pemberton (2021) and Pemberton (2023) especially Section II.

A temporal part of an enduring object can simply be defined as an entity whose identity is fixed by the identity of the object and a certain stretch of that object's "world line". Now, the endurantist may complain that this notion of a "temporal part" is just a logical construction which has been foisted upon him and has no fundamental status in his ontological system. That is to say, he may dismiss any such notion of a temporal part as being a mere abstraction from the more fundamental notions of a persisting object and a stretch of space-time occupied by that object. However, what he cannot, I think, plausibly claim is that, given his preferred ontology, such temporal parts of persisting objects do not exist at all. They do exist for his theory, even if he chooses not to accord them any fundamental ontological status but merely regard them as logical abstractions.<sup>44</sup>

It is just this account of temporal parts, which Lowe claims must exist, that I adopt here (see Sect. 4). Lowe goes on to say:

So the difference between an endurantist and his ... [perdurantist] rivals comes down to this, at most: whereas his rivals take momentary entities – temporal parts or stages – to be ontologically basic, he takes transtemporal entities to be ontologically basic. ... [Both] agree that there are both momentary and transtemporal entities, with the latter having the former as parts. The endurantist takes transtemporal entities to be basic and the momentary parts be ontologically secondary in status, describing the transtemporal entities as "persisting objects". The perdurantist takes the momentary parts to be basic and the transtemporal entities to be ontologically secondary in status, again describing the transtemporal entities as "persisting objects".<sup>45</sup>

According to Lowe, then, all endurantists are what I call temporal holists – and must be so because for an endurantist to reject temporal parts in the sense entailed is not possible, in Lowe's view. Moreover, Lowe supports endurantism – and hence, on his account, temporal holism. My paper here may thus be understood as re-articulating and developing the case for the temporal holist position proposed by Lowe.<sup>46</sup>

Still, some 20 years on from Lowe's work, I find little evidence that endurantists do in fact embrace temporal parts. They do not, for example, appeal to temporal parts in countering the arguments of perdurantists concerning problems of change. Nor, indeed, more generally, do they explicitly admit to temporal parts. I am therefore more cautious than Lowe in proclaiming endurantists to be temporal holists – I think it safer to accept the common view that endurantists rejects temporal parts, so that endurantism is a distinct position from TH. If some endurantists do, in fact, admit temporal parts in the way that Lowe thinks they must, then I suggest it would be helpful for them to relabel themselves as temporal holists.

<sup>&</sup>lt;sup>44</sup> Lowe (2006), p. 724.

<sup>&</sup>lt;sup>45</sup> Ibid, 724–725.

<sup>&</sup>lt;sup>46</sup> See also Lowe, (1987); Lowe (1998), chapter 4; McCall and Lowe, (2006).

# 9 Conclusion

TH, I argue, is an orthodox view historically that offers a compelling solution to the problem of changeable persisting objects (the problem of temporary intrinsics) and offers other significant ontological attractions. TH has the potential to complement other forms of holism, such as priority monism<sup>47</sup> and substantial holism,<sup>48</sup> that focus on holism with respect to spatial parts – such holisms have considerably enriched philosophical discourse in their own related areas in recent years.

Temporal holism has not generally been explicitly recognised as an ontological viewpoint within contemporary debates, and this despite the vigour of such debates on topics such as persistence and the nature of ordinary objects for which it has considerable relevance. TH, in brief, is a distinctive ontological position whose explicit recognition would much enrich contemporary philosophical discourse.

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# References

- Arntzenius, F. (2000). Are there really instantaneous velocities? The Monist, 83(2), 187-208.
- Bäck, A. (2014). Aristotle's theory of abstraction. Springer.
- Bechtel, W., & Abrahamsen, A. (2005). Explanation: A mechanist alternative. *Studies in the History and Philosophy of the Biological and Biomedical Sciences*, *36*, 421–441.
- Bigelow, J., & Pargetter, R. (1989). Vectors and change. The British Journal for the Philosophy of Science, 40(3), 289–306.
- Buonomo, V. (2018). Parts of persons; Identity and persistence in a perdurantist world. Ph.D. Thesis, Università degli studi di Milano.
- Carroll, J. W. (2002). Instantaneous motion. Philosophical Studies, 110, 49-67.
- Coope, U. (2005). Time for Aristotle. Oxford University Press.
- Craver, C. (2013). Functions and mechanisms: A perspectivalist view. In P. Huneman (Ed.), Functions: Selection and Mechanisms (pp. 133–158). Springer.

Edwards, C. H. (1979). The Historical Development of the Calculus. Springer.

Evnine, S. J. (2016). Making objects and events: A hylomorphic theory of artifacts, actions and organisms. Oxford University Press.

<sup>&</sup>lt;sup>47</sup> See, for example Schaffer (2010) and (2018).

<sup>&</sup>lt;sup>48</sup> See for example Inman (2018).

- Guay, A., & Pradeu, T. (2016). The genidentity of physical and biological processes. In Alexandre Guay & Thomas Pradeu (Eds.), *Individuals across the science chapter 16*. Oxford: Oxford University Press.
- Inman, R. D. (2018). Substance and the fundamentality of the familiar. Routledge.
- Johnson, M. (2005). Aristotle on teleology. Oxford University Press.
- Koons, R. C. (2020). Tracing Aristotle's revival, hoping for another. Sapienta.
- Koons, R. C. (2014). Staunch vs faint-hearted hylomorphism: towards an Aristotelian account of composition. *Res Philosophica*, 91(2), 151–177.
- Lange, M. (2005). How can instantaneous velocity fulfil its causal role? *Philosophical Review*, 114(4), 433–468.
- Lewis, D.K. (1986). Philosophical Papers, Vol. II. Oxford University Press
- Lewis, D. K. (1986b). On the Plurality of Worlds. Blackwell.
- Lowe, E. J. (1987). Lewis on perdurance vs endurance. Analysis, 48, 65-72.
- Lowe, E. J. (1998). The possibility of metaphysics. Oxford University Press.
- Lowe, E. J. (2006). Endurantism versus perdurantism and the nature of time. *Rivista di Filosofia Neo-Scolastica*, 4, 713–727.
- Marmodoro, A. (2020) Hylomorphic unity. The Routledge handbook of metaphysics, 284-299
- McCall, S., & Lowe, E. J. (2006). The 3D/4D controversy: A storm in a teacup. Nous, 40(3), 570-578.
- Pasnau, R. (2011). Metaphysical themes 1274-1671. Oxford University Press.
- Pemberton, J. (2021). Powers: The No-Successor Problem. Journal of the American Philosophical Association, 7(2), 213–230. https://doi.org/10.1017/apa.2020.13.
- Pemberton, J. M. (2022). Aristotle's Solution to Zeno's Arrow Paradox and its Implications. Ancient Philosophy Today: DIALOGOI, 4(1), 73–95. https://doi.org/10.3366/anph.2022.0061.
- Pemberton, J. M. (2022a). Aristotle's alternative to enduring and perduring: lasting. Ancient Philosophy Today: Dialogoi, 4(2), 217–236. https://doi.org/10.3366/anph.2022.0069.
- Pemberton, J. M. (2023). Acting-arrangement ontology introduced. Durham University e-theses.
- Peterson, A. S. (2018). Unity, plurality and hylomorphic composition in Aristotle's metaphysics. Australasian Journal of Philosophy, 96(1), 1–13.
- Russell, B. (1948). Human knowledge. Routledge, Taylor & Francis Group.
- Russell B. (2010). Principles of mathematics. Routledge, Taylor & Francis Group
- Russell, B. (1913). On the notion of cause. Proceedings of the Aristotelian Society, New Series, 13, 1-26.
- Scaltsas, T. (1994). Substances & universals in Aristotle's Metaphysics. Cornell University Press.
- Schaffer, J. (2010). Monism: The Priority of the Whole. Philosophical Review, Vol. 119, No. 1.
- Schaffer, J. (2018). Monism. The Stanford Encyclopedia of Philosophy. Ed. Edward N. Zalta. https:// plato.stanford.edu/archives/win2018/entries/monism/.
- Sider, T. (2001). Four-dimensionalism. Oxford University Press.
- Simpson, W. M. R. (2023). Hylomorphism. Cambridge University Press.
- Simpson, W. M. R., Koons, R. C., & Teh, N. J. (2018). Neo-Aristotelian Perspectives on Contemporary Science. Routledge.
- Skrzypek, J, W. (2022). Priority Perdurantism. Erkenntnis (forthcoming).
- Spinoza, B. (1996). Ethics. Penguin Classics.
- Stillwell, J. (2016). The Real Numbers: An introduction to set theory and analysis. Cham: Springer.
- Tooley, M. (1998). In defence of the existence of states of motion. *Philosophical Topics*, 16(1), 225–254. Tugby, M. (2024). *Teleology*. Cambridge University Press.
- Wasserman, R. (2016). Theories of persistence. Philosophical Studies, 173, 243-250.
- Waterlow, S. (1982). Nature, change and agency in Aristotle's physics. Oxford University Press.
- Zeyl, D. and Sattler, B. (2022). Plato's Timaeus. *The Stanford Encyclopedia of Philosophy*. Ed. Edward N. Zalta. https://plato.stanford.edu/archives/sum2022/entries/plato-timaeus/.

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