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Temporal holism and its challenge to mosaicism

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Abstract:	<p>Temporal holism is the view that concrete things (such as substances) obtain through some period of time and are ontologically prior to their temporal parts. Temporal holism is, then, a holism with respect to temporal parts – it contrasts with and complements other forms of holism, such as priority monism and substantial holism, that focus on holism with respect to spatial parts. Temporal holism has major implications for, inter alia, the nature of persistence and modality.</p> <p>Aristotle is a temporal holist, I argue – so that temporal holism is a well-established philosophical position. As his temporal holism has gone surprisingly unremarked within the secondary literature, I make a thorough case here that this is indeed Aristotle’s position, offering multiple overlapping arguments. I set out, too, how we may specify a family of contemporary temporal holist ontologies.</p> <p>Temporal holism offers an alternative to mosaicism – the view that dominates much contemporary philosophy according to which the world comprises a mosaic of instantaneous spatio-temporal tiles (the view of Russell and Lewis for example). The articulation of this alternative, which has not hitherto featured prominently within the contemporary debate, aims to promote consideration of this potentially attractive ontological position, and to offer a challenge to mosaicists to set out explicit arguments in favour of their preference for a mosaic view. Such arguments for mosaicism in preference to temporal holism are, I suggest, not yet widely articulated – and without them the temporal holist challenge renders the mosaicist position insecure.</p>

Temporal holism and its challenge to mosaicism

1 Introduction

Temporal holism is the view that concrete things (such as substances) are (what I shall call) *lasting*¹, that is to say (roughly) that they obtain through some period of time and are ontologically prior to their temporal parts. Temporal holism is, then, a holism with respect to temporal parts – it contrasts with and complements other forms of holism, such as priority monism and substantial holism², that focus on holism with respect to spatial parts. Temporal holism has major implications for, inter alia, the nature of persistence and modality.³

Aristotle is a temporal holist, I shall argue – so that temporal holism is a well-established philosophical position and neo-Aristotelians are (in general) temporal holists. As Aristotle's temporal holism has gone surprisingly unremarked within the secondary literature, I shall make a thorough case here that this is indeed Aristotle's position, offering multiple overlapping arguments in section 2.

I describe in section 3 how we may specify a family of contemporary temporal holist ontologies by selecting some preferred account of ontological priority (of a whole over its temporal parts) together with other salient assumptions.

Temporal holism offers an alternative to mosaicism – the view that dominates much contemporary philosophy according to which the world comprises a mosaic of instantaneous spatio-temporal tiles (the view of Russell, Lewis and many other neo-Humeans, for example). The articulation of this alternative, which has not hitherto featured prominently within the contemporary debate⁴, aims to promote consideration of this potentially attractive ontological position, and (as explain in section 4) to offer a challenge to mosaicists to set out explicit arguments in favour of their preference for a mosaic view. Such arguments for mosaicism in preference to

¹ I introduce and define the term '*lasting*' in this paper (and elsewhere in my work) in the apparent absence of any explicit existing terms for this concept within the literature. I set out a precise account of lasting (including consideration of ontological priority) in Section 3.

² See, for example Schaffer 2010 and 2018 (priority monism) and Inman 2018 (substantial holism).

³ I address these implications for persistence and modality in further detail in [anon].

⁴ Note that temporal holism differs from endurantism, although these positions are in some ways related. Temporal holism supposes that concrete things have potential temporal parts (a term I shall explain carefully below), whereas endurantism typically rejects temporal parts tout court. For a careful discussion of the distinction between these positions see [anon].

temporal holism are, I suggest, not yet widely articulated – and without them the temporal holist challenge renders the mosaicist position insecure.⁵

I formulate (in section 5) some possible objections by mosaicists to the claim that justification of their position is required – and set out some responses to these objections.

2 Aristotle's temporal holism

To secure the case that Aristotle is temporal holist is, I take it, to establish that temporal holism was the orthodox philosophical position through to the seventeenth century, and that neo-Aristotelians are, in general at least, temporal holists. As Aristotle's temporal holism has received surprisingly little consideration in the secondary literature, I shall make a thorough case here that this is indeed Aristotle's position, setting out multiple overlapping arguments which support this view.

To argue that Aristotle is a temporal holist is to argue that his concrete things are *lasting*, that is to say (roughly) that they obtain through some period of time and are ontologically prior to their temporal parts. Before setting out direct arguments that Aristotle's concrete things are lasting (in sections 2.3 and 2.4), I first show ways in which Aristotle's ontology is consistent with lasting concrete things: lasting fits with Aristotle's general mereology (section 2.1), and Aristotle is explicit that motions are lasting, so that there are at least some lasting entities (namely motions) in Aristotle's ontology (section 2.2).

2.1 *Lasting fits with Aristotle's more general mereology*

My first step in arguing that Aristotle is a temporal holist is to show how lasting fits with Aristotle's more general mereology.

Aristotle supposes that a whole is metaphysically different from a mereological sum (e.g. a heap or a bundle), contrary to what is widely supposed in contemporary philosophy. The difference for Aristotle lies in the fact that a whole is more strongly unified than a sum.⁶ In Aristotle's ontology, what explains the higher level of unification of a whole over a sum is that a whole is ontologically prior to its (potential) parts. The parts, on my reading, derive their identity from the identity of

⁵ Elsewhere I set out various arguments for the relative attractiveness of temporal holism compared to mosaicism (see e.g. [anon]), hence increasing the challenge to mosaicism. Space does not permit me to rehearse these arguments here.

⁶ Aristotle, *Metaphysics*, V.26. I need not digress into the details of the current debates concerning the unity of substances, and most notably the hylomorphic unity of matter and form, as this is tangential to my arguments here – but for discussion see e.g., Koons 2014, Peterson 2018, Marmodoro 2020, Simpson 2022.

the whole (Aristotle, *Metaphysics*, VII, 10). A hand, for example, a part of a body, must be defined by reference to the body as a whole, and hence derives its identity from the whole (Aristotle, *Metaphysics*, VII, 1035b10).

We may note that according to Aristotle's mereology (which differs markedly from orthodox contemporary mereology), wholes do have parts - they are not simples – but these parts cannot be separated from the whole, except by abstraction.⁷ Aristotle takes such parts to be *potential* not *actual*. Wholes then have potential but not actual parts – they are not composed of parts, perhaps with inter-relations between them. Mereological sums, on the other hand, are composed of actual parts – these actual parts are ontologically prior to the composite, the sum.

Aristotle's holism with regard to spatial parts is widely discussed and commonly recognised amongst Aristotelians.⁸ In considering the lasting of concrete things, I am focusing on temporal, rather than spatial, parts. In arguing that Aristotle's concrete things are lasting, i.e. that they are ontologically prior to their temporal parts⁹, I am arguing that Aristotle's holism extends to temporal as well as spatial parts. Temporal holism is, then, compatible with Aristotle's holism of substances with respect to their spatial parts, and might thus be considered unsurprising – a position that we might expect Aristotle to hold.

2.2 Aristotle is explicit that motions are lasting

Before presenting direct arguments that concrete things are lasting, I shall argue that Aristotle is explicit that motions (kineses) are lasting – this, on my reading, is Aristotle's only explicit commitment to the lasting of any entities. (For entities other than motions, notably concrete things, we may infer Aristotle's support for lasting, as I argue below.) The presence of some (explicitly) lasting entities within the ontology (i.e. motions) makes more plausible the claim that other (albeit very different) entities (such as concrete things) are also lasting – or, at least, that is my claim.

What is the relationship between motions (e.g. the flight of an arrow) and concrete things (e.g. an arrow) in Aristotle's ontology? This is a complex matter subject to exegetic debate which I shall not seek to address here. Rather, I establish Aristotle's commitment to the lasting of motions as providing firm evidence of at least some lasting entities within Aristotle's ontology.

⁷ In the case of functional parts (e.g. the hand as a part of the body) separation would result in loss of function of the part and hence its identity – a severed hand would be a hand in name only (*Metaphysics*, VII, 1035b23-25). Motions, too, are unities on Aristotle's account - see Section 2.2 below - so that the stages are ontologically dependent on the whole motion (they do not compose the motion).

⁸ See for example Pfeiffer 2018.

⁹ I argue that for Aristotle concrete things do have temporal parts below.

Let's consider motions (kineses), then – entities which are central to Aristotle's account of change and to his ontology. Change occurs, on Aristotle's account¹⁰, when an agent is in suitable contact with a correlate patient, so that their correlate agent-patient powers are activated¹¹ – the salient changing is in the patient.

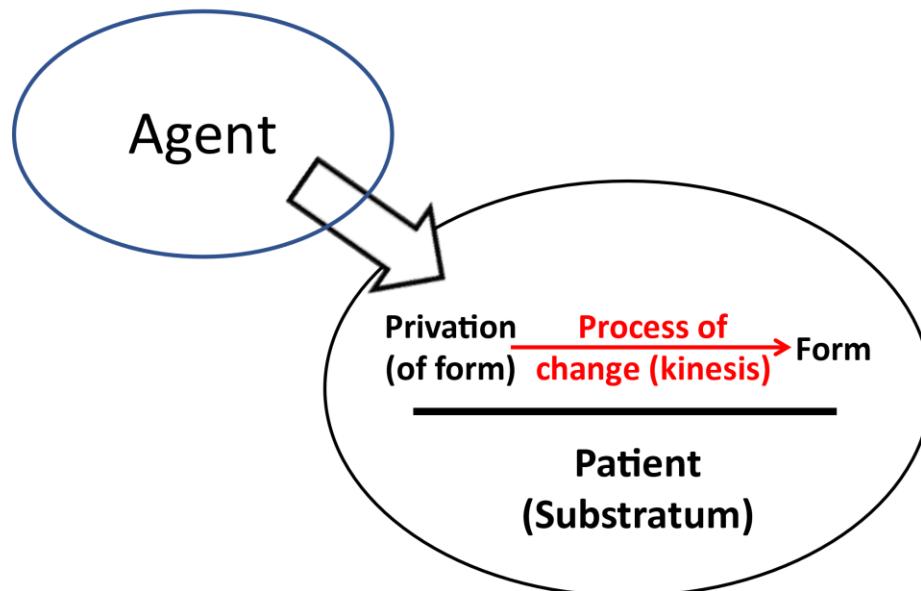


Figure 1: Agent, patient and process of change (kinesis, i.e. motion)

The correlate powers are in suitable contact and manifesting through time, so that the patient is changing through time. Aristotle uses the term *kinesis* to refer to the process of change, or motion, which is this changing over time. This process results in the change over time of the patient from being without (i.e. in privation of) a form to having a form (i.e. being enformed). The process may be understood as the transmission of a form to the patient (substratum) by the agent.

For example, when a builder (agent) and building materials (patient) are in suitable contact, building occurs, i.e. the becoming built of the building materials. This changing of the building materials over time is a process of changing (a motion) which results in e.g. a house – at the end of the process the patient substratum (building materials), which initially lack (are in privation of) the form of the house, has taken on the form of the house; the builder has transmitted the form of the house which was in her/his mind, to the building materials.

As the motion may be understood as the transmission of a single form, we might perhaps infer on teleological¹² considerations that it must be a unity. However, we need not rely on such inference as the unity of a motion (and hence its lasting) is a point on which Aristotle is explicit: he characterises motions as (temporally)

¹⁰ Aristotle, Physics I.7-8; Physics, III.1; Physics 202a5-11; Physics 202a13-15. For discussion see Waterlow 1982, Sections III and IV; Marmodoro 2007.

¹¹ I.e., they are in a state of activation – they are manifesting.

¹² I.e. on consideration of the directedness of the motion towards some telos or end. For discussion of Aristotle's teleology see Johnson 2005.

continuous (Aristotle, Physics, V.4, 228a20), whilst defining ‘continuous’ (in his refined, second, definition) as follows:

*‘The continuous is that which is next to something, but I call them continuous only when the limits at which they are touching are one. And it is clear from this definition that the continuous is among those things out of which some one thing naturally comes into being as a result of their uniting.’*¹³

This definition is concerned with the unity of (potential) parts of a continuous thing – a unity that yields a whole. Aristotle’s continuous things can be continuous either spatially, i.e. with respect to their (potential) spatial parts (as in the case of a body and its parts such as hand and heart), or temporally, i.e. with respect to their (potential) temporal parts (as in the case of the flight of an arrow and the stages of that flight). In the case of a motion, we are concerned with temporal parts of an entity that is temporally continuous. Aristotle, in advancing his second definition of continuity whilst ascribing motions as continuous, makes explicit that motions are unities: the conceptual temporal stages of the motion are in fact not many but rather one as the end of each (conceptual) stage just is the beginning of the next (‘the limits at which they are touching are one’). In being such unities, the motions are ontologically prior to their temporal parts – they are lasting.

As confirmation that Aristotle takes motions to be lasting, if it is thought to be needed, Aristotle uses the lasting of motions to solve Zeno’s arrow paradox, a central task of the Physics. Aristotle may be understood as formulating the paradox by way of the following syllogism¹⁴:

A1: The flying arrow does not move in any instant.

A2 (The *composition assumption*): The flight of the arrow is composed of instants¹⁵.

C: The flying arrow does not move.

Aristotle resolves the paradox by rejecting assumption (A2), that the flight of the arrow is composed of instants: *‘Zeno’s reasoning, then is wrong: for he says that if everything is always at rest when it is in a given place, while what is changing place is always doing so in the now, then the flying arrow is motionless. But this is false, for time is not composed of indivisible nows, just as no other magnitude is.’* (Aristotle, Physics VI.9 239b 5-9). The rejection of the composition assumption rests on his assumption (discussed above) that the flight of the arrow is ontologically prior to its temporal parts (i.e. it is lasting) – and hence it is not composed of instantaneous temporal parts (it *‘is not composed of indivisible nows’*).¹⁶

¹³ Aristotle, Physics, V.3, 227a10-14. Translation Sachs 2011, p140.

¹⁴ Zeno’s original texts setting out the paradox are lost. This is the formulation implied by Aristotle, who is widely taken to be our best available source – see Physics VI.9.

¹⁵ An instant is a shortest duration of time. Both Aristotle and orthodox contemporary thinkers take time to be continuous – I follow that orthodoxy here (i.e. I suppose time is isomorphic to the Reals). We may then take an instant to be a single point in time.

¹⁶ For a fuller account of Aristotle’s solution to Zeno’s arrow paradox see [anon].

2.3 Aristotle's concrete things are lasting – direct argument

As we have noted, a leading rival view to lasting is that concrete things are built from ontologically prior instantaneous parts – a view I dub mosaicism. Consider first substances, Aristotle's paradigm examples of concrete things. Here are five arguments that on Aristotle's account substances are not composed of instantaneous temporal parts:

1. Substances, on Aristotle's account, have *natures*, i.e. internal principles of change and rest.¹⁷ A principle of change and rest would seem to have no useful meaning in relation to an entity that exists for a single instant. (An entity that exists at a single instant cannot change.) It seems implausible that substances (which are natured) could be built from ontologically prior instantaneous parts (which cannot, it seems, have natures).
2. 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 existing at a single instant, or with their being built from entities which exist at a single instant (supposing that teleological beings cannot be built from non-teleological beings).
3. Substances within the superlunary sphere, such as stars, are explicitly eternal, on Aristotle's account. Such eternity is a source of perfection. It seems inconsistent with Aristotle's account to suppose that, rather than being ontological unities, such entities achieve the perfection of eternity on account of being built from a dense infinity of ontologically prior instantaneous entities (that stretches out throughout all time).
4. Sublunary substances, strive for the perfection of the unmoved mover both in respect of its eternity and its eternal motion.¹⁸ (The unmoved mover is a supra-physical entity.) Substances in the sublunary sphere, such as animals, cannot attain eternity by themselves – but by reproducing they can, on Aristotle's account, ensure the eternity of their species. The degree of perfection achieved in respect of eternity 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 eternity (Aristotle, *On the soul*, II.4, 415b2-8). Individual substances obtain over some period of time so as to collectively achieve eternity. If reproductive substances were themselves composed of temporal parts, it

¹⁷ See e.g., Waterlow 1982.

¹⁸ Aristotle, *On generation and corruption*, II.10, 336b, 25-36; Dudley 2012, especially 116-117.

seems the degree of approximation to eternality of the species would be lower still. It would seem highly doubtful as to whether substances built from instantaneous entities would underwrite the achievement of any degree of perfection at all – and implausible that Aristotle supposed that such substances are indeed built from instantaneous temporal parts.

5. Aristotle is explicit that '*nothing moves in the now*' (Aristotle, Physics VI.3 234a24). An instantaneous entity could not, then, imitate the motion of the unmoved mover. Again, it seems implausible that substances (which do seek to imitate the motion of the unmoved mover) could be built from instantaneous entities (which could not).

On each of these arguments, Aristotle's account is not compatible with substances being composed of instantaneous temporal parts.

How about concrete things that are not substances, heaps and bundles of elemental matter (earth, air, fire, water) perhaps? On Aristotle's account elemental matter is characterised by its moving towards its proper place (e.g. earth moves downwards, fire upwards). If such elemental matter obtained for a single instant, it could not exhibit such characteristic moving – and this would contradict Aristotle's suppositions concerning such matter. It seems that concrete things that are not substances – as well as substances – could not be instantaneous, nor yet composed of instantaneous temporal parts.

Might concrete things nevertheless be composed of non-instantaneous temporal parts? This raises the question as to how such non-instantaneous temporal parts might be determined in a principled way: how might we choose to divide the underlying time period into halves, quarters, or some other of the infinitely many possible partitions in order to specify non-instantaneous temporal parts? Even if such a principled basis for partitioning the time period were forthcoming, non-instantaneous actual temporal parts would conflict (at least to some extent) with the unified nature of substances (as in (1)), unified teleological action (at least where the temporal parts divide the period of action), as in (2), the perfection of eternal substances (as in (3)), and the partial perfection of sublunary substances (as in (4)). (1)-(5) above, together with difficulties associated with a principled partition of non-instantaneous parts, thus represent a series of overlapping arguments against concrete things having either instantaneous or non-instantaneous actual temporal parts.¹⁹ I am unaware of any explicit arguments that, on Aristotle's account, concrete things do have actual temporal parts.

One might wonder: If Aristotle's concrete things do not have actual temporal parts, might they be temporal simples, i.e. have no temporal parts of any kind (not even potential temporal parts)? Substances may change, on Aristotle's account. On Aristotle's account, time is the number of change in respect of the before and

¹⁹ As explained in section 2.1, on Aristotle's account entities have actual parts just in case they are composed of those parts – these parts are then ontologically prior to what they compose.

after²⁰: we can ascribe (temporal) numbers to things corresponding to the stages of their change, and it would seem that this provides a basis for paying selective attention to the stages of their change²¹ – and hence to abstracting temporal parts²². At least in this sense of licensing the abstraction of temporal parts, it would seem that Aristotle's things do have (potential) temporal parts.²³

These overlapping arguments offer firm grounds for supposing that Aristotle's things have potential (but not actual) temporal parts, and hence are lasting.

2.4 Aristotle's solutions to certain key problems of change are predicated upon the lasting of concrete things

Aristotle's key aims within the Physics include showing how P can come from $\neg P$ and that change is real.²⁴ I shall describe here how Aristotle's solution to both of these key problems is predicated upon the lasting of concrete things. The predication of key arguments upon the lasting of concrete things further supports the case that Aristotle does suppose concrete things are lasting.

2.4.1 How P can come from $\neg P$ – the case of accidental change

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*' (Aristotle, Physics, I.8, 191a25-28). If P comes from P, then we do not have change - to have change, P must come from $\neg P$. A widespread concern amongst the ancients was that change (the becoming of P from $\neg P$) must then imply the becoming of being from not-being. It was generally agreed, including by Aristotle, that coming from not-being would be problematic.

Aristotle solves the problem of P coming from $\neg P$ by positing an underlying substratum of change that exists throughout the process of change from P to $\neg P$. In the case of accidental change, which I focus on here, change occurs within a concrete thing, perhaps a substance. On Aristotle's account PA, say, comes to be from $\neg PA$ - for example a musical person comes to be from an unmusical person.²⁵

²⁰ Physics IV.10-14, Coope 2005.

²¹ What about a substance or other concrete thing that happens not to be undergoing change during some period? Here we may suppose that it is contemporaneous with other substances that are undergoing change – and that we may then use the temporal numbers of these other substances as a basis for the abstracting the unchanging substance's temporal parts.

²² Abstraction may be understood as involving the paying of selective attention to certain aspects – see e.g. Bäck 2014. Abstracted parts, as in the case of a hand, may often exist in time and space and hence be physical – this is the case for both spatial and temporal parts.

²³ Jonathan Lowe makes a similar argument that things must have temporal parts at least in this limited sense of abstraction – see Lowe 2006, page 724.

²⁴ $\neg P$ should be read not-P.

²⁵ Aristotle, Physics I.7-8. 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.

This solution supposes that the substance obtains through the period of change: it remains numerically the same whilst changing from one state to another. How is this possible? If the substance were a composite of temporal parts, it would lack the required unity with respect to these parts to underwrite the required numerical sameness.²⁶ If it were temporally simple, i.e. totally lacking in temporal parts, then the achievement of a change of state would be problematic. For Aristotle, on my reading, it is the lasting of the substance (or other class of concrete thing) which licenses this change of state whilst staying numerically the same: the potential temporal parts of the substance may have different accidents at different times, but they all derive their identity from the substance as a whole.

2.4.2 The reality of change

In order to establish the reality of change, Aristotle appeals to the actuality of the potentiality for change whilst that potentiality remains in being: *'Change is the actuality of what is potentially, when that which is potential is actually active not as itself but as something which is capable of change.'* (Aristotle, Physics, III.1, 201a27-29). This actuality, which obtains over some period of time, is, in practice, changing over time. We see that Aristotle secures the reality of change by securing the reality of changing: where changing is the actuality of certain potentialities. In the paradigm case of changing arising from correlate agent and patient powers, it is the actuality of these correlate powers.²⁷ Changing arises just when the agent and patient are in suitable contact over some period of time - their correlate powers are activated (i.e. actualised) over this period of time.²⁸ And in order to undertake their teleological roles²⁹ within the process of change over this period, each of these entities (i.e. powers and power-bearers) must exist through this period. Each of these entities must, then, be lasting.³⁰

In the case of natural change³¹, the natural being must be lasting in order to underwrite the changing (e.g. developing) through time of the natural being.

Lasting of concrete things (e.g. agents, patients, natural beings), then, is required and presupposed in Aristotle's demonstration of the reality of change.

²⁶ See Scaltsas 1994 for a discussion of the unity of substances with regard to their parts.

²⁷ As described in Aristotle's account of change set out in section 2.2 above.

²⁸ Aristotle, Physics, III.1-3; see Marmodoro 2007.

²⁹ Within Aristotle's ontology, powers and power-bearers are telic entities, i.e. entities that are oriented towards some goal.

³⁰ [Anon].

³¹ See Aristotle, Physics, 192b8-23 and Waterlow 1982.

2.5 Aristotle's concrete things are lasting - summary

Lasting is consistent with, and might be expected in light of, Aristotle's commitment to the priority of wholes over their parts. Aristotle is explicit that motions are lasting – there are then lasting entities within Aristotle's ontology – and, indeed, entities which are in the vicinity of concrete things. I have set out direct arguments that Aristotle's concrete things are lasting (section 2.3) and made the case that Aristotle supposes the lasting of concrete things in key arguments concerning change (section 2.4). I suggest that together these overlapping arguments provide a strong case that Aristotle's concrete things are lasting – that is to say that Aristotle is a temporal holist.

3 A family of temporal holist ontologies

Recognising Aristotle's temporal holism opens the door for us to consider other possible temporal holist ontologies. A common assumption of any such ontology must be that concrete things are lasting – that is the defining characteristic of temporal holism of course. In order to license and render well-defined the range of temporal holist ontologies, it will be helpful and appropriate to characterise lasting somewhat more generally and precisely than we have so far³². We may take a *lasting* entity to be one which:

1. *Is physical (so that it exists in space and time)*³³;
2. *Exists for some period of time*³⁴;
3. *Is ontologically prior to its temporal parts.*

3.1 Ontological priority over temporal parts

In Aristotle's case, the ontological priority of a lasting whole over its temporal parts, i.e. characteristic 3, is achieved via the identity dependence of the parts upon the whole (on my reading)³⁵. In the more general characterisation of lasting given here, the nature of the ontological priority of the lasting entity over its temporal parts is left open, and it may be supposed that contemporary philosophers may propose accounts of this priority which are consistent with their respective broader

³² See also [anon] for more on lasting.

³³ I suppose here the existence of a classical (non-quantum) domain in which objects have determinate positions, and focus in this paper on this domain, remaining agnostic here as to how this domain may be related to any quantum domain.

³⁴ That is to say, if lasting entity *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 $\forall t \in [T_0, T_1]$.

³⁵ I take my identity-dependence reading to be consistent with Scaltsas' view of the unity of substances (Scaltsas 1994), for example – but the form of ontological priority supposed by Aristotle is tangential to my argument here, so I shall not pursue this point further.

ontologies (which may likely differ from Aristotle's account of priority). This characterisation of lasting is not then tied to Aristotle's ontology.

Aside from Aristotle's identity-dependence account of the ontological priority of a lasting whole over its temporal parts, what other accounts of such ontological priority might there be? This is, on my reading, a largely unexplored question and one I shall not attempt to answer fully here – rather, I shall suggest the following possible directions for such exploration.

- Brute unity. Perhaps the temporal unity of lasting entities is brute: the physical entities we find in the world are lasting, 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 are brute lasting, and that these lasting building blocks compose to form higher level entities which inherit their lasting from these building blocks.
- Teleological unity.³⁶ Perhaps the grounds of the temporal unity of some or all lasting entities 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 actings. As well as human intentionality as a model for such teleology, the functional roles of entities taken to be mechanical (perhaps ones of the sort posited by the new mechanists³⁷) might provide a basis for lasting.
- Causal unity. Perhaps the temporal unity of lasting entities might be underwritten by some form of causal influence between stages: e.g. later stages of a lasting entity 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 Spinoza³⁸. Or alternatively, it might have resonance with mosaicist accounts of persisting (common-sense) things such as that of Lewis and Russell for example, which both, in their differing ways, suppose that causal connections play a role in the unity of persisting things (albeit not at the fundamental level), alongside juxtaposition and similarity relations³⁹).
- Continuity-based unity. Perhaps lasting entities 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

³⁶ I.e. unity achieved by reference to some telos (i.e. some end or purpose). For discussion of Aristotle's teleology see Johnson 2005.

³⁷ See for example Bechtel & Abrahamsen 2005; Craver 2013.

³⁸ Spinoza 1996, especially part III, prop 6.

³⁹ See Russell 1948, part VI; Lewis, 1986, xiii.

continuity account of unity might resonate with ‘genidentity’ accounts of unity⁴⁰, 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 - presumably an account which is yet to be discovered or, at least, widely disseminated.

In making these suggestions, I do not, of course, mean to limit any exploration of other possible grounds of temporal unity – many areas of investigation might prove fruitful. Any specific account of temporal unity, at least any that is plausible, fills in one assumption in the set of assumptions which determine a specific account of lasting ontology – a member of the family of possible lasting ontologies.

3.2 Other ontological assumptions

The supposition that concrete things are lasting, together with an assumption concerning the nature of the ontological priority of wholes over their temporal parts (i.e. fixing the account of lasting in play), establishes the key temporal holist assumption. This leaves open all other assumptions concerning the ontology (allowing that these assumptions must be compatible with the temporal holist assumption). In principle it would seem that we may adopt any other preferred assumptions, including, indeed, those assumptions which perhaps we have chosen to adopt within our preferred mosaicist ontology. The ontological issues on which we might choose to adopt assumptions may, for example, include (but are certainly not be limited to):

- The nature of properties, e.g. tropes, instantiated universals, type of universals, etc.;
- How compossible properties form an object, e.g. whether there are bundling relations and if so their form;
- The nature of space and time.

It may of course be that certain assumptions are not mutually compatible or at least not plausible or attractive companions within an assumption base. Perhaps some assumptions do not fit well, on some opinions, with the preferred lasting assumption. Such incompatibilities may then limit the range of possible ontologies. Nevertheless, it would seem that the family of temporal holist ontologies may be very large.

The range of possible ontological assumptions determining a lasting ontology are wider than those which might reasonably be deemed Aristotelian – Aristotelian /

⁴⁰ See for example Guay and Pradeu 2016.

neo-Aristotelian ontologies form only part, and likely a small part, of the family of lasting ontologies

4 Temporal holism challenges mosaicism

4.1 Mosaicism

A leading view within contemporary philosophy holds that the world comprises a mosaic of instantaneous spatio-temporal tiles. A leading example of such a view is the subscription of neo-Humeans to a Humean Mosaic. David Lewis expresses it thus:

‘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 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.’ (Lewis, 1986, ix).

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); different accounts of the tiles – e.g. as ‘states’ or ‘events’⁴¹. There have been many mosaicists over the years - mosaicist ideas can arguably be traced to Plato’s account of the Receptacle within the *Timaeus*.⁴²

Mosaicists do not, to be clear, deny the existence of concrete things which persist through time within their ontologies – rather, concrete things on the mosaicist accounts are pluralities of adjacent and perhaps 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 (Russell 1948, 429-30).

4.2 A challenge to mosaicism

Mosaicist ontologies suppose that instantaneous tiles are the fundamental building blocks of ontology, so that persisting concrete things are derivative entities built from such fundamental tiles. Temporal holist ontologies, by contrast, suppose that concrete things are lasting – they are ontologically prior to their temporal parts, not built from them; instantaneous tiles are not posited. Temporal holism thus offers a distinct alternative to mosaicism.

⁴¹ ‘An “event” may be defined as a complete bundle of compresent qualities’ (Russell, 1948, 78).

⁴² Especially on spatial, as opposed to material, accounts of the Receptacle – see e.g. Zeyl and Sattler 2022, section 6.

If my arguments so far are along the right lines, then there are indeed available temporal holist ontologies, including Aristotelian, neo-Aristotelian and other contemporary versions. This family of temporal holist ontologies then offers an alternative to mosaicism. The existence of an alternative to mosaicism (which may or may not have comparative attractions) represents a challenge: In the face of an alternative, arguments are required to secure the validity and preferability of mosaicist assumptions. Such arguments are not yet, I suggest, apparent within the literature.

Ex ante, it would seem an open question as to whether we should opt for a temporal holist ontology or for a mosaicist one. As we have noted, contemporary philosophers mostly opt for mosaicism - what is their case for doing so?

In practice, one reason would seem to be that temporal holism does not seem to have featured prominently as a position within the contemporary debate. The temporal holist credentials of Aristotelian ontologies have (as I note above) not been widely articulated. And other lasting ontologies, according to my investigations, have not, been widely developed.⁴³ If this is so, then one reason that mosaicism is preferred would seem to be that an alternative has not been considered. One aim of this paper is to raise the profile of temporal holism within the current debate so that arguments for and against this position and its competitors may be advanced, and hence our understanding of the alternative positions strengthened.

5 Possible objections to requests for justification of mosaicism

Are there, though, grounds upon which mosaicists could resist the pressure for justification of their ontological assumption of a mosaic?

Perhaps they might seek to argue that temporal holism is not, contrary to my claim, a possible ontological position, neither in Aristotelian nor non-Aristotelian versions. I do not know how any such argument might go – but if there is such an argument, then it would likely be a valuable addition to the literature.

Or perhaps they might argue that the popularity of mosaicism amongst leading philosophers, its success in advancing metaphysics and providing a foundation for the advancement of science, and its historic defeat of Aristotelian dominance, render any challenge inadmissible. Relative popularity, even if accepted, is surely not a conclusive argument. Whether contemporary philosophy has succeeded in much

⁴³ Jeremy Skrzypek (Skrzypek 2022) and Valerio Buonomo (Buonomo, 2018, chapter 2) also discuss the possibility of persisting wholes which have ontological priority over their temporal parts, and thus consider ontologies which are, on my reading, at least loosely related to temporal holism as described in this paper – but discussions of such ideas have not been widespread.

advance is a topic of debate⁴⁴, as is its efficacy as a foundation for science.⁴⁵ And the current resurgence of Aristotelian thinking gainsays any claims of its defeat.⁴⁶ Such arguments against challenge should not, I suggest, be accepted.

Or perhaps they might identify some knock-out metaphysical arguments in favour of mosaicism in preference to lasting. Let's briefly consider some possibilities.

1. It might be argued that point-in-time entities (in some sense) fit with (and are perhaps required as the truth-makers of) sentences in the present tense – so that common language usage implies there must be point in time entities along the lines proposed by mosaicism. Supporters of lasting might reply that how a lasting entity is at some point in time (which may be abstracted from that lasting entity) is also a suitable truth-maker for such sentences. Moreover, lasting entities might claim a fit with tenses such as the present continuous, which might be a reason for preferring them. In any case, inferences from common language usage to ontology are far from secure.
2. Another possible argument is that popular contemporary accounts of time, such as eternalism, presentism, growing-block, suppose that points in time (*e.g.*, the present point in time) exist, and that this underwrites an argument for the existence of point-in-time building blocks of ontology. If such an argument could be articulated and be found to have merit, it would likely establish a connection between the assumed account of time and mosaicism. These accounts of time (*e.g.* eternalism) and mosaicism might then be found to stand or fall together. Still, this would not yet be an argument for mosaicism. Lasting ontologists will likely wish to reject eternalist views, seeing these as mosaicist accounts of time. Like Aristotle, they will likely wish to adopt accounts of time which fit with lasting ontologies.⁴⁷
3. Could it be argued that mosaicism fits with contemporary science and must therefore be preferred? For this to be an argument for mosaicism in preference to lasting, the claim must be that mosaicism fits better with science than lasting. Whether this is so may only be judged correctly once contemporary lasting ontologies are articulated and assessed.

Perhaps others can find ways to improve arguments along these lines, or perhaps advance other stronger arguments for mosaicism in preference to lasting. If there are such arguments then, again, they would surely be a valuable addition to the philosophical literature. But this is work yet to be done, on my reading – and whether it can be done remains to be seen.

⁴⁴ See, for example, Dietrich 2011, Chalmers 2015.

⁴⁵ See for example the work of Nancy Cartwright (*e.g.* Cartwright 1999, 2007, [anon]).

⁴⁶ See for example Simpson et al 2018, Koons 2020, Austin 2021.

⁴⁷ As Aristotle did. For Aristotle's account of time as the number of change in respect of the before and after, see *Physics*, IV.10-14 and Coope 2005.

In my own work elsewhere, I argue that temporal holist ontologies have strong attractions as compared to mosaicist ontologies - for example, in underwriting attractive accounts of change and the bringing about of change⁴⁸. Space does not permit presenting these arguments here. Insofar as these, or other arguments for the relative attractiveness of temporal holism are successful, the challenge to mosaicism is increased.

6 Conclusion

Aristotle is a temporal holist, and we may articulate a family of non-Aristotelian temporal holist positions. These positions represent alternatives to mosaicism. Temporal holism thus provides a challenge to mosaicism. My aims in articulating this challenge include both supporting work to develop temporal holism as an alternative ontological position, and prompting mosaicists to clarify their case for mosaicism.

Various other holist ontologies have been advanced in recent years, perhaps most notably monist ontologies such as that of Jonathan Shaffer⁴⁹. These have, I suggest, added valuably to relevant philosophical debates. The discussion of these holisms has, though, been principally focused on spatial parts and not been much concerned with temporal parts. Consideration of the temporal holist challenge to mosaicism is an opportunity to further advance current debates, exploring promising but largely unconsidered ontological positions.

⁴⁸ See [anon].

⁴⁹ See, for example Schaffer 2010 and 2018. See also Inman 2018 on substantial holism.

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