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Possible Parthood and Modal-Mereological Composition

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Abstract

I argue that, if we take the world-time parallel seriously, then those who support Sider's (2001) argument for unrestricted diachronic composition (UDC), establishing the existence of temporal parts, should also hold that its modal analogue, my argument for unrestricted modal composition (UMC), establishes the existence of modal parts. I formulate the latter argument and develop it by testing it against objections. Editor's Note: Best Conference Paper, 17th Annual Pacific University Undergraduate Philosophy Conference (2013)

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Possible Parthood and Modal-Mereological Composition

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Abstract

I argue that, if we take the world-time parallel seriously, then those who support Sider's (2001) argument for unrestricted diachronic composition (UDC), establishing the existence of temporal parts, should also hold that its modal analogue, my argument for unrestricted modal composition (UMC), establishes the existence of modal parts. I formulate the latter argument and develop it by testing it against objections.

Ted Sider's *Four-Dimensionalism* (2001) has been influential in framing the contemporary metaphysical debate concerning persistence. Sider offers several compelling arguments favoring the existence of temporal parts, chief among them his 'Argument from Vagueness' – or the argument for unrestricted diachronic composition (UDC), as I will call it. I argue that if we take the world-time parallel seriously, then those who hold that the UDC establishes the existence of temporal parts should also hold that its modal analogue, the argument for unrestricted modal composition (UMC), establishes the existence of modal parts. Just as UDC establishes that ordinary objects are temporally extended mereological composites (composed of temporal parts), UMC establishes that ordinary objects are modally extended mereological composites (composed of modal parts).¹ UDC grants the existence of objects entirely composed of, say, the molecules in David Lewis's hand in 1980 and the molecules in Ursa Major in 1950, whereas UMC grants the existence of objects entirely composed of, say, Ted Sider (who exists in the actual world) and a unicorn (which exists in a non-actual possible world). I claim that there is at least as good a reason to believe that UDC establishes the existence of temporal-mereological composites as there is to believe that UMC establishes the existence of modal-mereological composites. First, I outline UDC (§1). Next, I argue that there is good reason to believe the world-time parallel to be a metaphysical parallel. Then I formulate UMC (§2). Finally, I raise and respond to the following objections: UMC is committed to possibilism; UMC does not motivate the idea that the parthood relation can occur across worlds (§3).

1. Sider's Argument for UDC

The soundness of UDC has been hotly debated in the secondary literature, but I do not attempt to contribute to this debate here. Rather, I argue that if UDC is sound, then UMC is also likely to be sound. Or, alternatively, I argue that since the conclusion of UDC is that objects have temporal parts, the soundness of UDC implies that there is as good a reason to believe that objects have modal parts as there is to believe that objects have temporal parts.

The idea of an object's having modal parts has been little-explored in contemporary literature – discussion of modal parts, however, has not been completely neglected. Modal continuants, for example, are entities with modal parts and have been offered as a way to preserve counterpart-theoretic-style semantics for *de re* modality while also avoiding the Humphrey objection levied against counterpart theory (Lewis 1983:41).² But what the arguments for modal continuants do not establish is that objects can indeed have modal parts – the existence of trans-world composites (and their modal parts) is simply assumed and the benefits of these assumptions analyzed.³ UMC, however, will motivate the existence of modal parts, so my thesis can be seen to have utility outside of metaphysical persistence debates.

For the purposes of this paper, I will assume the soundness of Sider's UDC and hold fixed all of his presuppositions that are needed for UDC to succeed. This means that I will assume – with Sider (2001:120) – the linguistic theory of vagueness (i.e. vagueness is a linguistic phenomenon) and maintain the assumption that eternalism is true (110). For ease of exposition, I will also adopt Sider's terminology. Call an assignment, $f(t)$, a *t*-assignment iff $f(t)$ is any function taking one or more times as inputs and assigning non-empty classes of objects that exist at those times as outputs (133);⁴ say that a class of objects is a temporal case of composition, or *t*-case, whenever the objects in that class stand in important temporal-mereological relations (e.g. spatial adjacency, qualitative similarity, causal relatedness, etc.); and n number of *t*-cases form a continuous series iff each *t*-case is pair-wise similar (134). I follow Sider and define 'temporal part' as follows (59):

- (TP) x is an instantaneous temporal part of y at time $t =_{\text{def}}$ (1) x exists at, but only at, t ; (2) x is part of y at t ; and (3) x overlaps everything that is a part of y at t .⁵

Finally, x is a minimal D-fusion of $f(t)$ iff (1) for all t in the domain of $f(t)$, x is a fusion-at- t of $f(t)$; and (2) for all t' such that t' is not in the domain of $f(t)$, x is not a fusion-at- t' .⁶

Consider now, Sider's formulation of UDC (134):

- P1 If not every t-assignment has a minimal D-fusion, then there must be a pair of t-cases connected by a ‘continuous series’ such that in one, minimal D-fusion occurs, but in the other, minimal D-fusion does not occur.
- P2 In no continuous series of t-cases is there a sharp cut-off in whether minimal D-fusion occurs.
- P3 In any t-case of minimal D-fusion, either minimal D-fusion definitely occurs or minimal D-fusion definitely does not occur.

P1 would only be denied by mereological nihilists, those who hold that minimal D-fusion never occurs.⁷ However, the nihilist position faces a significant problem: if gunk (an object all of whose proper parts have proper parts) is possible – and it *prima facie* appears to be – then mereological nihilism is false.⁸ It is to be understood, then, that the mereological nihilist cannot simply assert the falsity of P1 without first arguing against the possibility of gunk (179-80), so it is dialectically appropriate to consider P1 true.

P2 is supported by the idea that any sharp cut-off is “metaphysically arbitrary” (124). Suppose further that a sharp cut-off were motivated in a non-arbitrary way; for instance, let minimal D-fusion occur only over a continuous interval of time, or let a set of definite topological restrictions on space-time dictate when minimal D-fusion occurs: the existence of temporal parts would still be established by UDC (136).⁹

Support P3 with the following argument: if P3 is false, then possibly it is a vague matter whether some object x is a minimal D-fusion. Since P3 could be false in a world with finitely many objects, then a statement asserting ‘there are exactly n number of objects’ would have an indeterminate truth-value in this world because it would always be vague whether the objects in this world composed a further object, namely a minimal D-fusion. But sentences of the form ‘there are exactly n number of objects’ cannot have indeterminate truth-values, so P3 is not false (127). Recall Sider’s assumption above that vagueness is a linguistic – not a metaphysical - phenomenon; now understand the denial of P3 to entail metaphysical vagueness, which contradicts the assumption.

P1, P2, and P3 entail a principle of unrestricted diachronic composition: for any number of times t_p and any number of objects x_q existing at those times there is an object y that is the minimal D-fusion of x_q at t_p . P1 requires that a restriction on when minimal D-fusion occurs requires a continuous series of t-cases where in at least one t-case, minimal D-fusion occurs, and in an adjacent t-case, minimal D-fusion does not occur. P3 requires a sharp cut-off in the continuous series of t-cases and P2 prohibits a sharp

cut-off. Therefore, minimal D-fusion always occurs and, where there is minimal D-fusion, there are temporal parts.

2. The World-Time Parallel and the Argument for UMC

The world-time parallel is a parallel that exists between tense logics and modal logics. Specifically, the parallel occurs between the tense operators ‘always’/‘sometimes’ and the modal operators ‘necessarily’/‘possibly’ in model theories of tense and modal logic. These four operators interact with the axioms of their respective models in similar ways and, due to the semantic similarities between the operators, formal results proved in one model typically have analogous results in the other model (Meyer 2006:25). It is this part of the world-time parallel that everybody can agree with: the formal results are apparent and cannot be readily denied. Where the world-time parallel becomes controversial is when it is applied to metaphysics whereupon it states that the metaphysical nature and ontological status of times and possible worlds should parallel one another: arguments given for/against the existence of times should have analogous arguments for/against the existence of possible worlds and vice versa. This metaphysical parallel is not entirely unmotivated, especially when one considers the nature of arguments given in the metaphysics of time and possible worlds. For example, an eternalist may object that the presentist’s tense-logical model cannot account for the truth of sentences involving diachronic relations. A possibilist can analogously object that the actualist’s modal-logical model cannot account for the truth of sentences involving trans-world relations. These analogous arguments can be made because many take ontological commitment to be a function of what entities are quantified over in the logical models used to represent metaphysical talk about worlds, times, etc.¹⁰ If the specified domain of a presentist model must include only present objects, yet that model nevertheless quantifies over non-present entities, one has reason to believe that the presentist model does not accurately reflect the metaphysical structure of the world. Since tense models and modal models are analogous, there is strong reason to suppose that there are analogous reasons for rejecting an actualist model. Thus the world-time parallel between tense and modal-logical models suggests a parallel between the metaphysics of time and the metaphysics of possible worlds.

I say that a metaphysical world-time parallel is suggested – or strongly implied – by the logical parallel, not that it is entailed. There is, in fact, an interesting way in which the metaphysical parallel is broken that is pertinent to the topic of this paper. First, distinguish between temporal versions of a principle of unrestricted composition: unrestricted synchronic composition versus unrestricted diachronic composition (Balashov 2010:78-9). The former asserts that at any time t , any class of objects existing at t has a minimal fusion-at- t . The latter asserts that at any times t_1, t_2, \dots, t_n , any class of objects existing at t_1, t_2, \dots, t_n has a minimal D-fusion. Notice that the diachronic principle entails the synchronic principle.¹¹ Now consider a similar distinction between modal principles: unrestricted intra-world composition versus

unrestricted inter-world composition. The former asserts that in any world w , any class of objects existing in w has a minimal fusion-in- w , and the latter states that in any worlds w_1, w_2, \dots, w_n , any class of objects existing in w_1, w_2, \dots, w_n has a minimal fusion. Notice that the inter-world principle entails the intra-world principle. Notice also that, under the assumption of eternalism, the intra-world principle is equivalent to the diachronic principle. Therefore, a principle of unrestricted inter-world composition – which is established by UMC – entails a principle of unrestricted diachronic composition – which is established by UDC – though the reverse does not hold. Yet this metaphysical asymmetry does not show that the world-time parallel is a useless tool. Since the parallel nevertheless remains between logical models, and since metaphysicians often follow the ontological commitments of the logical models they use, there remains a *prima facie* reason to investigate the world-time parallel in other metaphysical scenarios.

We can now introduce the assumptions needed for UMC, i.e., modal analogues of the assumptions Sider utilized in UDC. I continue to assume that vagueness is a linguistic phenomenon. In addition to assuming eternalism I also assume its modal analogue, possibilism, the thesis asserting that possible but non-actual entities exist.¹²

Modal terminology for UMC can also be introduced, where the modal terms are analogous to Sider's temporal terminology for UDC. Call an assignment, $f(m)$, an m-assignment iff $f(m)$ is any function taking one or more worlds as inputs and assigning non-empty classes of objects that exist in those worlds as outputs; say that a class of objects is a modal case of composition, or m-case, whenever the objects in that class stand in important modal-mereological relations (e.g. qualitative similarity, counterfactual dependence, counterpart or rigid designation relations, etc.); and n number of m-cases form a continuous series iff each m-case is pair-wise similar. Define a modal part as follows:

- (MP) x is a world-restricted modal part of y in world $w =_{\text{def}}$ (1) x exists in, but only in, w ; (2) x is part of y in w ; and (3) x overlaps everything that is a part of y in w .

Finally, call x a minimal M-fusion of $f(m)$ iff (1) for all w in the domain of $f(m)$, x is a fusion-in- w of $f(m)$; and (2) for all w' such that w' is not in the domain of $f(m)$, x is not a fusion-in- w' .

Now UMC may be formulated as follows:

- P1* If not every m-assignment has a minimal M-fusion, then there must be a pair of m-cases connected by a 'continuous series' such that in one, minimal M-fusion occurs, but in the other, minimal M-fusion does not

occur.

- P2* In no continuous series of m-cases is there a sharp cut-off in whether minimal M-fusion occurs.
- P3* In any m-case of minimal M-fusion, either minimal M-fusion definitely occurs or minimal M-fusion definitely does not occur.

Again, P1* will only be denied by one who asserts that minimal M-fusion never occurs, i.e. a mereological nihilist. But once again the nihilist must first argue against the possibility of gunk if P1* is to be denied.

Let us try, in opposition to P2*, to motivate a sharp cut-off for when minimal M-fusion occurs; say, x is a minimal M-fusion of $f'(m_1)$ iff some class S_1 is the output of $f'(m_1)$ and every member of S_1 is either x or a counterpart of x that exists in the closest non-actual possible world.¹³ Assuming we can mark a sharp cut-off for which worlds are 'closest' to the actual world, the above characterization would, if properly motivated, result in a sharp cut-off for when minimal M-fusion occurs. However, this sharp cut-off still grants the existence of modal parts, so P2* is vindicated.

The support for P3* will be similar to the support for P3. If P3* is false, then there can be m-cases where it is vague whether minimal M-fusion occurs. If it is vague whether minimal M-fusion occurs, then statements of the form 'there exist exactly k number of objects between worlds $w_1, w_2, \dots,$ and w_n ' would have indeterminate truth-values when worlds $w_1, w_2, \dots,$ and w_n contain a finite number of objects. But since possibilism and the linguistic theory of vagueness are assumed, such statements cannot have indeterminate truth-values. P3*, therefore, cannot be false.

P1*, P2*, and P3* entail a principle of unrestricted modal composition: for any number of worlds w_p and any number of objects x_q existing in those worlds there is an object y that is the minimal M-fusion of x_q in w_p . P1* asserts that a restriction on when minimal M-fusion occurs requires a continuous series of m-cases where, in at least one m-case, minimal M-fusion occurs, and in another m-case, minimal M-fusion does not occur. P3* requires a sharp cut-off in the continuous series of m-cases and P2* prohibits a sharp cut-off. Therefore, minimal M-fusion always occurs and, where there is minimal M-fusion, there are modal parts.¹⁴

3. Objecting to UMC

The similarities between UDC and UMC should be clear. An argument against UMC will *prima facie* prompt an analogous argument against UDC. Two objections, however, could potentially defeat UMC without defeating UDC.

First, since the modal terminology of UMC requires that Lewisian modal realism be true, UMC fails because there are independent reasons for holding Lewisian modal realism to be false. UDC's assumption of eternalism does not carry this stigma. I reply that the alleged commitment to Lewisian modal realism is only an appearance. The modal terminology can easily be translated in such a way that it is consistent with other forms of possibilism, though the conclusion of UMC will no longer be that objects can have concrete modal parts. For example, if one prefers an ersatzist or abstractionist version of possibilism, asserting that possible worlds are abstract objects, then the conclusion of UMC would be that objects can have abstract parts and we would expect UDC to establish the existence of abstract temporal parts.¹⁵ Even under this alteration of the possibilist assumption, the conclusion of UMC remains interesting and controversial. Nevertheless, the possibilist assumption may not be warranted and, if that is the case, then UMC fails to establish the existence of modal parts, whether abstract or concrete. Modal fictionalism presents a strong challenge to the legitimacy of UMC because, if modal fictionalism is true, it will be strange to say that UMC establishes the existence of fictional parts. Fictional parts of objects are not modal parts of an object – they are not parts of an object at all! Apart from several antecedent issues involved with modal fictionalism,¹⁶ I would still want the modal fictionalist to provide a good explanation for why temporal fictionalism fails. Adhering to modal fictionalism – or any kind of actualism, for that matter – without adhering to its temporal analogue in the setting of this paper is not dialectically appropriate.

A second objection is the following: UMC does not give one good reason to hold that the parthood relation can relate objects that exist in different possible worlds. Certainly there are some relations (e.g. spatiotemporal relations) that cannot occur across worlds, so UMC further needs to establish that the parthood relation does not fall into this set of relations. Additionally, some relations do not “survive” the world-time transition and parthood may be such a relation; e.g. ‘before’/‘after’ does not appear to have a modal analogue. I reply that we need not hold that the same parthood relation occurs in UMC and UDC. There are at least arguments in favor of compositional pluralism, i.e. the thesis that there is more than one fundamental parthood relation (McDaniel 2004:142). If so, the fact that the temporal parthood relation does not “survive” the world-time transition is no problem: there is an analogous modal parthood relation. If it is granted that there is a parthood relation that relates entities existing at different times, then we can use compositional pluralism and the world-time parallel to argue that there is an analogous modal parthood relation that relates entities existing in different worlds. The success of UDC and the world-time parallel can now be seen to support UMC and its conclusion that objects have modal parts.

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¹ The parthood relation and the composition relation are inverses of one another, so if a parthood relation is instantiated, so is a composition relation.

² The Humphrey objection to counterpart theory: consider the statement 'Hubert Humphrey might have won the election'. Under counterpart theory, this means that Humphrey has a counterpart in some accessible possible world and that counterpart won the election. However, Humphrey could not care less about what happens to somebody in another possible world, but if Humphrey were identical to his counterpart, then Humphrey would care whether 'Humphrey might have won the election' is true (Kripke 1980:45n).

³ Actually, the existence of trans-world composites (and their proper modal parts) is not merely assumed. Instead, modal continuant theorists (e.g. Varzi) drop the axiom in

Lewisian counterpart theory that individuals must be world-bound, though that seems to be an *ad hoc* way of avoiding the Humphrey objection.

⁴ In what follows, I will preface terms with a ‘t’ or an ‘m’/‘M’ or a ‘D’ to stand for ‘temporal’ or ‘modal’ or ‘diachronic’ respectively. E.g. D-fusion is a diachronic fusion, m-case is a modal case of composition, t-part is a temporal part, etc.

⁵ Where parthood, $<$, is a primitive mereological notion, overlap is defined as follows: x overlaps y (i.e. $x \bullet y$) iff $(\exists z)(z < x \wedge z < y)$. That is, x overlaps y if and only if something is a part of both x and y (Simons 1987:12).

⁶ Fusion is defined as follows: x is a fusion of class S iff $(\forall y)(y \in S \rightarrow y < x) \wedge (\forall z)(z < x \rightarrow z \bullet y)$. That is, x is a fusion of S if and only if every member of S is a part of x and every part of x overlaps every member of S . I will use ‘fusion’ and ‘composite’ so that they bear the same ontological implications.

⁷ P1 can also be resisted by a mereological essentialist, i.e. one who holds that the parts of an object are essential to that object. In this paper I do not have the space to fairly consider the objection posed by mereological essentialism (cf. Sider 2001:180-8), so I will set aside the issue.

⁸ Proper parthood, $<<$, is defined as follows (taking parthood as primitive): $x << y$ iff $(\exists x)(\exists y)(x < y \wedge x \neq y)$. Since proper parthood is transitive, gunky objects have a regress of proper parts. This is problematic for the mereological nihilist because she holds that ordinary objects, like tables and chairs, do not instantiate the parthood relation, but are rather ‘molecules-arranged-tablewise’ or ‘particulate-matter-arranged-chairwise’. Since the nihilist is committed to the existence of simples (i.e. objects that do not have proper parts), gunk is a pressing problem.

⁹ Temporal parts would be established in this scenario because the sharp cut-off would still allow for the existence of at least some minimal D-fusions. From the definition of minimal D-fusion, the existence of a minimal D-fusion entails the existence of temporal parts.

¹⁰ See, for example, Quine (1980) for a defense of the idea that existential quantification is a guide to ontological commitment.

¹¹ The entailment arises from considering the principle of unrestricted diachronic composition when the number of times is equal to 1.

¹² It is important to note that UMC can still succeed without assuming eternalism.

¹³ Another suggested sharp cut-off would be to allow minimal M-fusion to occur only between objects in worlds that are accessible from each other.

¹⁴ Of course, there is a trivial sense in which the existence of a minimal M-fusion establishes the existence of modal parts, namely when x is identical to both y and to a world-restricted part of y . UMC, however, also establishes a more interesting sense of modal parthood: a modal version of perdurantism (Benovsky 2006:153) where objects are modally extended composite objects with different parts existing in different possible worlds.

¹⁵ UDC would establish the existence of abstract temporal parts because we would expect the move to ersatz possibilism to illicit an analogous move to ersatz eternalism, which claims that non-present times are abstract objects.

¹⁶ Modal fictionalism suffers from at least four objections that would need to be answered prior to invoking this position to block the conclusion of UMC, namely: (i) modal fictionalism makes modality too artificial (Nolan 2002:81); (ii) the modal fiction must always be incomplete because there are an infinity of true modal statements and finite agents could never tell the whole fiction (87); (iii) it is not clear what the truth-bearers of modal claims can be under modal fictionalism (88); (iv) modal truths become redundant under modal fictionalism (93). Although I do not hold that these objections are insurmountable, I do hold that these objections need to be satisfactorily dealt with by the modal fictionalist before modal fictionalism can be considered a serious threat to UMC.