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Inheriting harmony

Claudio Calosi

1. *Introduction*

Supersubstantivalism has been recently discussed – and defended – both in metaphysics – for example, Morganti 2011, Dumsday 2016, Giberman forthcoming, and in philosophy of physics – for example, Lehmkuhl 2018. One of the most powerful considerations in favour of supersubstantivalism is the *argument from harmony*. In a recent paper Leonard (2021) provides a new take on such an argument. Leonard takes supersubstantivalism to be roughly the view that material objects are *identical* to the spacetime regions at which they are *exactly located*.[1] I will mostly follow this characterization, but I will return to it briefly in §5. The *argument from harmony* is approximately the following. There is a certain *harmony* between material objects and their locations. Necessarily, if material object x is located at a spherical region, x is spherical. Necessarily, if material object x is located at region r, any part of x is located at a part of r. Leonard calls the former 'G-Harmony' for 'geometrical harmony' and the latter 'P-Harmony' for 'parthood harmony'.

1 *Exact Location* is a core notion in theories of location. See e.g. Casati and Varzi 1999, Parsons 2007 and Gilmore 2018. *Spacetime Substantivalism* is assumed. I will omit the 'exact' specification from now on.

Analysis Vol. 82 | Number 1 | January 2022 | pp. 23–32 doi: 10.1093/analys/anab055

Supersubstantivalists, so the argument goes, have a straightforward explanation of both G-Harmony and P-Harmony. By contrast, *dualists* – those who hold that material objects are *distinct* from their locations – do not have such an explanation and should regard harmony principles as *unexplained coincidences*. In this paper I put forward a theory, which I shall call the 'Inheritance Theory', that provides a straightforward explanation of both G-Harmony and P-Harmony on behalf of dualists.

2. *Harmony, Supersubstantivalism and the Identity Theory*

Leonard (2021: 2–3) formulates Harmony and Supersubstantivalism as follows:

(G-Harmony) Necessarily, if x is located at region r, then x is the same size and shape as r.

(P-Harmony) Necessarily, if x is located at region r, y is located at region s and x is part of y, then r is part of s.

(Supersubstantivalism) Necessarily, x is located at region r iff x is a material object and $x = r$.

Supersubstantivalism provides a straightforward explanation of both G- and P-Harmony in that *it entails both*. Leonard claims that, whilst this is true, Supersubstantivalism itself cries out for an explanation. In his own words:

> Doesn't [Supersubstantivalism] also cry out for an explanation? Why is it true? The purported explanation for (G-Harmony) and (P-Harmony) simply introduces yet another modal mystery. That's hardly a satisfying explanation. (Leonard 2021: 3)

Let me call this the *explanatory objection*. Leonard suggests that supersubstantivalists should meet the *explanatory objection* by adopting what he calls the 'Identity Theory of Location'. This is the higher-order identification below – where $\psi \equiv \phi$ expresses the higher-order identification that to be ψ is to be ϕ, @ stands for location and O is the predicate 'being a material object':[2]

(Identity Theory) $\lambda x \lambda r\,(x@r) \equiv \lambda x \lambda r(O(x) \wedge x = r)$

Informally, for x to be located at r is for x to be a material object identical to r. Leonard shows that the Identity Theory entails Supersubstantivalism, and therefore both G- and P-Harmony. Furthermore it is not vulnerable to the *explanatory objection* insofar as identity claims are natural stopping points for explanations. In this paper I will grant this much about identity and explanation, and work with higher-order identifications myself. The core of the *argument from harmony* is, as we saw, that dualists do not have an

2 For higher-order identity claims see Rayo 2015, Dorr 2016 and Correia and Skiles 2019.

explanation for G- and P-Harmony. One can take issue with this way of framing the problem and insist that, *pace* Leonard, supersubstantivalists do not face any deep modal mystery regarding location. According to Supersubstantivalism location is metaphysically shallow. In effect, supersubstantivalists need not include location in their fundamental ideology. They can have only identity. Thus, so the thought goes, it is not the case that supersubstantivalists have an explanation for a mystery that dualists do not have. According to Supsersubstantivalism there is no mystery to begin with. This consideration gives the dialectic a new twist, but it does not let dualists off the hook. Dualists have location in their ideology, and the argument from mereological harmony is still a threat *for them*. Harmony principles *still look like unexplained coincidences*. Here is Schaffer:

> For the dualist, the geometrical and mereological harmonies between material objects and spacetime regions *seem an amazing coincidence*. What prevents, for instance, my hand from occupying a region with a different shape? Or what prevents my hand from occupying a region that is not part of the region my body occupies? (Schaffer 2009: 138, italics added)

And here is Leonard himself:[3]

> (G-Harmony) and (P-Harmony) seem to cry out for an explanation. Why are they true? For the dualist, *this looks like a remarkable coincidence*. (Leonard 2021: 2, italics added)

This is where the Inheritance Theory comes in.

3. *The Inheritance Theory*

The core claim of the Inheritance Theory is that material objects simply *inherit* some of their properties and relations from their locations. The germ of this idea is clearly stated by Hudson:

> [I]t seems quite natural (. . .) to think that regions have their shapes intrinsically, and that material objects have their shapes extrinsically insofar as they *inherit* them from the regions they occupy. (Hudson 2006: 111, italics added)

In what follows I give a precise formulation of this germinal idea. In particular, I will use higher-order identifications and use the logic of $\equiv$ to put forward a possible explanation of harmony on behalf of dualists. As a first stab, the idea to be developed is that for x to be ψ is for x to be a material object that is located at a ψ-region – for *some* relevant condition ψ. And for material objects x and y to stand in a 2-place relation ψ_2 is for their locations to be ψ_2-related. Similarly for n material objects standing in an n-place relation ψ_n. To simplify notation, I will use a two-sorted logic where $x, y, \ldots, z$ range

3 See also e.g., Skow 2007: 116, Le Bihan 2016: 2166 and Giberman forthcoming: 5.

only over material objects, and $r, s, \ldots, v$ range *only* over regions.[4] The templates for the Inheritance Theory are then:

(Monadic Inheritance) $\lambda x(\psi(x)) \equiv \lambda x(\exists r(x@r \wedge \psi(r)))$

(2-Place Inheritance) $\lambda x \lambda y(\psi_2(x, y)) \equiv \lambda x \lambda y(\exists r \exists s(x@r \wedge y@s \wedge \psi_2(r, s)))$

(n-Place Inheritance) $\lambda x \lambda y \ldots \lambda z(\psi_n \underbrace{(x, y, .., z)}_{n\,variables})$
$\equiv \lambda x \lambda y \ldots \lambda z(\underbrace{\exists r \exists s \ldots \exists v}_{n\,variables}(x@r \wedge y@s \wedge \ldots \wedge z@v \wedge \psi_n(r, s, \ldots, v)))$

for *some* relevant ψ_n. What we are really interested in here are specific examples of Monadic and 2-Place Inheritance. Let G stand for a predicate variable that can take any geometric predicate in the range of harmony as values. Then, we can offer the following schematic version of Geometric Inheritance, or G-Inheritance$_s$. One obtains relevant instances of the schema by replacing G with the appropriate geometrical properties:[5]

(G-Inheritance)$_s$ $\lambda x(G(x)) \equiv \lambda x(\exists r(x@r \wedge G(r))$

For 2-Place Inheritance, simply let ψ_2 be the parthood relation $\sqsubseteq$. Then, Parthood Inheritance, or P-Inheritance is:

(P-Inheritance) $\lambda x \lambda y(x \sqsubseteq y)) \equiv \lambda x \lambda y(\exists r \exists r(x@r \wedge y@s \wedge r \sqsubseteq s))$

In plain English, G-Inheritance$_s$ is the claim that, for example, for x to be spherical/of size s/(...) is for it be a material object located at a spherical/of size s/(...)-region.[6] P-Inheritance is the claim that for x to be part of y is for x to be located at a part of y's location. The same analysis can be applied to n-place relations such as the 3-place relation 'x is between y and z' or the 4-place relation 'x is at the same distance from y than w is from z'. Let me be clear. It is not my intention to defend either G- or P-Inheritance – nor it is to defend

4 Alternatively, one can eschew a two-sorted logic and (i) add the axiom $x@y \rightarrow O(x) \wedge R(y)$ to the point that the first argument of @ is an object and the second a region, and (ii) add $O(x)$ – or $O(x) \wedge \ldots \wedge O(z)$, depending on the adicity of ψ – as a conjunct in the scope of the λ-operator on the left-hand side of $\equiv$ in the higher-order claims in the main text.

5 Alternatively, one can offer a quantificational variant. In this case, one invokes quantification into predicate position and has condition C pick out the aforementioned properties – (G-Inheritance)$_q$: $\forall G : C(G)(\lambda x(G(x))) \equiv \lambda x(\exists r(x@r \wedge G(r)))$.

6 G-Inheritance$_q$ is the claim that for any geometrical property, for x to have that property is for x to be located at a region with that property. For the purposes of the paper, differences between the two do not matter.

dualism for that matter.[7] I am only interested here to see whether G- and P-Inheritance can provide an explanation for G- and P-Harmony.

Before I turn to this it should be noted that the Inheritance Theory is *not meant* to provide a *reductive definition*, or an explanation of, for example, a particular G. In effect, G appears on both sides of $\equiv$ in G-Inheritance$_s$. Rather, it is meant to explain *what it is for a material object to have* G – and, in turn, why an object and its location share the same G. But this is different from an *explanation of* G *itself*. Metaphysics offers numerous examples of such a strategy. For example, in certain variants of perdurantism, a four-dimensional object is P (at t) by having a t-temporal part that is P. Sider's metaphysics of fundamentality features a principle of *purity* to the point that a *truth* is *fundamental* because it only contains *fundamental notions* (Sider 2011: 115). And it is orthodoxy in philosophical logic to hold that a *sentence* is *true* when the proposition it expresses is *true*. In all these cases, the template seems the same: some entities (objects, four-dimensional objects, truths and sentences) have a relevant property (G, P, being fundamental, being true) *indirectly* by being R-related (via location, parthood, involvement, expressing) to some other entities (regions, temporal parts, notions, propositions) that have *that* property *directly*. There is no circularity.

4. *Harmony, dualism and the Inheritance Theory*

The argument is now simple. Dualists *can* use G-Inheritance and P-Inheritance to provide a straightforward explanation for G- and P-Harmony: G- and P-Inheritance *simply entail* G- and P-Harmony respectively. Call this the *inheritance argument*. We just need a few details about the logic of $\equiv$, namely that $\psi \equiv \phi$ entails that (i) necessarily, every ψ is ϕ, and (ii) necessarily, every ϕ is ψ.[8]

It follows from G-Inheritance and (ii) that, necessarily, everything that is exactly located at a region with geometrical property P is P – where, for example, we obtain the relevant instance of G-Inheritance$_s$ by replacing G with P. Therefore, necessarily, every object shares its geometrical properties with its location. That is, G-Harmony holds.[9]

It follows from P-Inheritance and (i) that, necessarily, if x is part of y, then x and y are exactly located at regions r and s such that r is part of s. By logic alone, necessarily, if x is located at r, y is located at s and x is part of y, then r is part of s.[10] That is, P-Harmony holds.

7 In effect, one can endorse only one of them – if one so wishes – depending on whether one takes (instances of) G or $\sqsubseteq$ to be in the range of harmony.

8 See Rayo 2015: 49 and Correia and Skiles 2019: 646. Correia and Skiles note that (i) and (ii) follow from Leibniz's Law for $\equiv$. Dorr endorses Leibniz's Law for $\equiv$ in Dorr 2016: 49.

9 The same is true under G-Inheritance$_q$.

10 A referee for this journal rightly notes that multilocation – the view that objects can have multiple locations – complicates things. Suppose x is multilocated at r_1 and r_2, y is

Note that, insofar as one agrees with Leonard that identity claims are natural stopping points for explanation, then the *inheritance argument* is not vulnerable to the *explanatory objection*. This is because the Inheritance Theory is itself formulated in terms of higher-order identity claims. More generally, the Inheritance Theory is built in such a way that, for any condition ψ_n for which it holds, objects and their locations are in ψ_n-harmony. No mystery here. No unexplained coincidences. Simply, inheritance.

5. *Discussion*

To conclude, let me discuss possible objections to the Inheritance Theory.

One can presumably object to the Inheritance Theory in §3 on the grounds that it is a *radical theory*. Call this the *radicality* objection. According to the Inheritance Theory, material objects inherit properties and relations from their locations. They only have those properties or stand in those relations *indirectly*. This is radical. Or so the objection contends. To this one might simply reply that supersubstantivalists are in no position to make such a case. The Identity Theory is even *more* radical. To wit, the Identity Theory entails the Inheritance Theory, whereas the converse does not hold.[11] Yet, supersubstantivalism was supposed to be a radical thesis in the first place, whereas dualism was not. Granted. But one should note that the Inheritance Theory sounds radical only if one holds the view that material objects inherit *all* of their properties from their locations. But this is not part and parcel of the theory. Indeed, this is one of the (alleged) advantages of inheritance. Only *some* properties of material objects are inherited. Suppose Henry loves June. Love is *not* in the range of harmony. Love is *not* inherited. It is *not* the case that Henry's location loves June's location. Only the Identity Theory commits to its doing so. The Inheritance Theory does not. Furthermore, for properties such as shape or extension, one would need to *argue* rather

multilocated at r_3 and r_4, $x \sqsubseteq y, r_1 \sqsubseteq r_3$, but r_2 and r_4 are disjoint. Then P-Inheritance holds, yet one gets a counter-example to P-Harmony. Two things should be noted in response. First, if multilocation is possible, and material objects are allowed to *change* their mereological structure across different locations, then one would need to *relativize* mereological claims to locations. This is at least the common response in the literature – see e.g. Gilmore 2009. Suppose one relativizes mereological claims to *the location of the whole*. Then, P-Harmony should be: necessarily, if x is located at region r, y is located at region s and x is part of y *at* s, then r is part of s. The problematic case above will no longer be problematic – P-Harmony will come out as trivially true. Second, multilocation dramatically changes the overall dialectical landscape of the debate between Supersubstantivalism and dualism. This is because multilocation is simply incompatible with Supersubstantivalism. To see this, consider (i) $x@r_1$, (ii) $x@r_2$ and (iii) $r_1 \neq r_2$ – as required by multilocation. Then, by Supersubstantivalism, (iv) $x = r_1$, and (v) $x = r_2$. Hence, (vi) $r_1 = r_2$. Contradiction.

11 However, it should be noted that supersubstantivalists might not have location in their fundamental ideology in the first place. And, *pace* Leonard, they might not subscribe to the Identity Theory – see §2.

than simply *declare* that the view is radical.[12] This raises the following, natural question: what properties do material objects inherit from their locations? What properties do they not inherit? Call the former the *inherited* properties, and the latter the *direct* properties. Is there any principled distinction between *inherited* and *direct* properties? Here is a conjecture that I find interesting. Inherited properties are those for which harmony holds.[13] In a slogan: harmony is a *sign* of inheritance.[14] Naturally, we should be clear that a *sign* does not provide an *explanation* of what it is a sign of. That is to say, harmony does not explain inheritance. Inheritance explains harmony.

Relatedly, Schaffer (2009: 138–39) argues against *some version* of the Inheritance Theory. Schaffer does not have in mind the exact version of the Inheritance Theory I put forward in §3, but, arguably, a similar objection can be formulated against that exact version as well. Let me quote from Schaffer directly:

> [T]he major trouble (. . .) is that it begins the process of *relocating* material properties to the spacetime itself. Once one has pinned the geometrical and mereological properties directly onto the receptacle, *why stop there?* Why not also pin the masses and charges onto the receptacle as well? In general, is there some principled reason for using spacetime as the pincushion for only some of the fundamental properties? The dualist, having doubled the substrata, owes a principled account of how to divide the properties between them. (Schaffer 2009: 139)

Call this the *relocation* objection. It is clearly related to some issues I discussed already. In a nutshell, according to the *relocation* objection, the dualist owes us a principled reason to distinguish between *relocated* and *non-relocated* properties. Absent such a principled distinction, one should *relocate all properties* to spacetime, contra dualism.[15] Different replies are available. First, note that Schaffer's implicit distinction between relocated and non-relocated properties seems to parallel the distinction I drew between *inherited* and *direct*

12 Suppose one holds the following dualist view, inspired by Sider (2006: 393). A spacetime region r is a *bare particular*. A material object o is a thick particular, that is, a bare particular that *instantiates* certain properties – where *instantiation* is just a piece of the fundamental ideology of the theory. Crucially, $o \neq r$, for no thick particular is identical to a bare particular. This view would qualify as dualism in light of Leonard's characterization. G-Inheritance is indeed a natural option in this context. Where else would the shape of o come from? Giberman (forthcoming) discusses a supersubstantivalist counterpart of this view, under the label *bare particular identity supersubstantivalism*.

13 Naturally, if one holds this view one cannot endorse only one harmony principle between G- and P-Harmony.

14 Incidentally, the Inheritance Theory seems to provide us with a formidable metaphysics of love: love is always direct, it is never inherited, it is beyond harmony.

15 Note that the *relocation* objection does not work against particular variants of dualism, such as the one discussed in footnote 12.

ones. If so, the conjecture I discussed above (that harmony is a *sign* of inheritance), if borne out, would provide the principled reason Schaffer is looking for. I grant that this reply is in its infancy and cannot do too much to alleviate Schaffer's worries. More importantly, one can reply that the Inheritance Theory of §3 is *not relocating any property*. The inherited properties are *instantiated by – pinned onto – the material objects themselves*. In effect, this is exactly what the left hand-side of the higher-order identifications *explicitly shows*. The relevant properties are *not* relocated to spacetime. If something has a property indirectly, *it* still has that property.

Perhaps the real concern is not about 'relocation' per se. Rather, the worry is that the same property that is had *directly* by one entity – the spacetime region – is had only *indirectly* by another – the material object located at that region. However, this should not be too problematic. As we saw in §3, metaphysics offers plenty of similar examples – for example, 'being fundamental' or 'being true'. A related worry is that, under the Inheritance Theory, geometric properties, for example, shapes, are *intrinsic* to spacetime regions but *extrinsic* to material objects. Another example is, arguably, the property of 'having an extension $= n \in \mathbb{R}$'. In general, there are plenty of properties that are intrinsic to something and extrinsic to something else: 'being as good a writer as Henry Miller' is intrinsic to Henry Miller, but extrinsic to Samuel Beckett. The same goes for 'being distinct from Henry Miller's left hand'. In effect, this reflects what Marshall and Weatherson (2018) label the 'global [property *P* is *intrinisic*] vs. local [property *P* is *had intrinisically*]' distinction for intrinsicality.[16] Finally, one might insist that material objects have their shapes *intrinsically*, *contra* the Inheritance Theory. But insistence is not enough. This is where *an argument is needed*. For instance, Skow (2007) surveys

> all known theories of shape properties, and argue(s) that each theory is either incompatible with the claim that shapes are intrinsic, or can be shown to be false. (Skow 2007: 111)

In effect, one may be sceptical that shapes are intrinsic to *all kinds* of material objects. Liquids and gases arguably have their shapes *indirectly and extrinsically* by *being contained* in other material objects. In any event, one can even *concede* that the *extrinsicality* of shapes is controversial. The Inheritance Theory still significantly alters the dialectical landscape. The original charge was that dualists have *no explanation* for mereological harmony. Now, thanks to the Inheritance Theory, they *have one* – perhaps at some cost.

At this juncture, one should also note that there are other variants of supersubtantivalism that cannot exploit the *argument from harmony*. For instance, according to *constitution supersubstantivalism* – mentioned in Schaffer 2009:

16 Bader (2013: 554) goes so far as claiming that 'the local notion is prior to the global notion'.

133–34 and developed in Gilmore 2014 – material objects are *constituted by* their locations. If constitution does not entail identity – as it should not, on pain of collapsing the differences between different variants of supersubstantivalism – constitution supersubstantivalists cannot endorse the Identity Theory. The same goes for *priority supersubstantivalism* – defended in Lehmkuhl 2018. According to this variant, material objects are simply dependent/derivative on their locations. True, according to the characterization in Leonard 2021 these do not qualify as variants of supersubstantivalism in the first place. In effect, they qualify as dualist theories. Yet, Schaffer, Gilmore and Lehmkuhl all explicitly use the label 'supersubstantivalism'. As far as I can see, nothing precludes constitution or priority supersubstantivalists from endorsing the Inheritance Theory.

Thus, to those dualists and supersubstantivalists who find the *argument from harmony* compelling, and yet do not want to endorse the allegedly radical metaphysics of *identity supersubstantivalism*, I offer the Inheritance Theory as middle ground.[17] We can all live in harmony.[18]

Funding

This work was supported by the Swiss National Science Foundation, project number PCEFP1_181088.

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17 Giberman (forthcoming) defends *supertropestantivalism*. This is a version of *non-identity supersubstantivalism* according to which 'regions are pluralities of primitively geometrically and topologically alike tropes (…) [that] bundle together to form material objects' (Giberman, forthcoming: 2). Interestingly, as Giberman himself notes, *supertropestantivalism* has a straightforward explanation of harmony, which is *independent* of the Inheritance Theory.

18 I want to thank two anonymous referees for their insightful comments that improved the paper greatly. I also want to thank Johsua Babic, Lorenzo Cocco, Baptiste LeBihan, Matteo Morganti, Paolo Natali, Maria Scarpati and David Schroeren for discussion. But mostly, thanks to Fabrice Correia.

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A ground-theoretical modal definition of essence

JULIO DE RIZZO

1. Introduction

The notion of essence has a long history. In one of its chapters, Kit Fine (1994a) famously argued that a purely modal account of essential claims is fundamentally misguided, and developed a theory in which the notion of essence appears as a primitive.

However, even if Fine's criticism of the modal account is taken for granted, resorting to primitivism is surely not the only option available. In this paper, I

Analysis Vol. 82 | Number 1 | January 2022 | pp. 32–41 doi: 10.1093/analys/anab004