Supersubstantivalism, Harmony and Higher-order Identities

Andrea Salvador

University of Italian Switzerland (Lugano)

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Varieties of Supersubstantivalism

Lehmkuhl 2018 distinguishes between:

Modest	**Radical**
Every property of a material object is held directly by its location	Only some properties of a material object are held directly by its location + the remaining properties are reducible to the ones held by its location

Philosophy of Physics

Modest	**Radical**
Every property of a material object is held directly by its location	Only some properties of a material object are held directly by its location + the remaining properties are reducible to the ones held by its location
$\Uparrow$	$\Uparrow$
Schaffer 2009: GR, QFT $\Rightarrow$ identity-supersubstantivalism (IS)	Lehmkuhl 2018, Calosi and Duerr 2021: GR $\Rightarrow$ priority-supersubstantivalism (PS)

Metaphysics

Modest	**Radical**
Every property of a material object is held directly by its location	Only some properties of a material object are held directly by its location + the remaining properties are reducible to the ones held by its location
	?
⇑	
Skow 2007, Schaffer 2009: IS is the only metaphysical explanation of Harmony	

Metaphysics

The following is the principle of Harmony for Exact Location, where xLy means x is located at region y:

HARMONY

$$\Box\forall xy(xLy \;\rightarrow\; \text{G-Harmony} \wedge \text{P-Harmony})$$

- Geometry-Harmony: $Gx \leftrightarrow Gy$ $Gx : x$ has shape G
- Parthood-Harmony: $\forall zv(z \leqslant x \wedge zLv \;\rightarrow\; vLy)$

A possible objection to IS

Standard formulation of Identity-supersubstantivalism:

$$\text{(IS)} \quad \Box \forall xy(xLy \;\leftrightarrow\; Mx \wedge\; x = y)$$

$$Mx : x \text{ is a material object}$$

But see Skow 2007 on why Harmony should be explained:

> *Some material objects are spherical. Some regions of space are spherical. And it is* <u>*necessary that every spher -ical material object is located at a spherical region of space.*</u> *But* <u>*this*</u> *can't just be a magical, mysterious necessity, a necessity that must be unexplained. (p. 116)*

A possible objection to IS

Leonard 2021a:

1. necessary universal truths must be explained   Ass.
2. Harmony is a (mysterious) necessary truth   Skow 2007
3. Harmony needs to be explained   1,2
4. (IS) explains Harmony   IS
5. (IS) is a necessary truth   (IS)
6. (IS) needs to be explained   1,5
7. good explanations do not need to be explained   Ass.
8. (IS) is not a good explanation of Harmony   7,6

A new argument for IS

Leonard 2021a: (IS) is not a good explanation of Harmony.

Thus, Leonard 2021a provides a new explanation of Harmony which justifies IS.

Leonard endorses Rayo 2013's and Dorr 2016's view on identities (also higher-order ones):

> *Identities are excellent stopping places for explanation; they do not cry out for explanation in their own right. Indeed, there is something odd about questions like 'Why is Hesperus Phosphorus?'. [...] it is hard to know what would count as a satisfying answer. (Dorr (2016, p. 41))*

A new argument for IS

Leonard 2021a's new explanation of Harmony by IS involves a higher-order identity.

It is the Identity Theory:

$$\text{(IdT)} \quad \lambda xy(xLy) \; \equiv \; \lambda xy(Mx \wedge x{=}y)$$

By Rayo 2013's and Dorr 2016's logic, we have that $\phi{\equiv}\psi$ entails $\Box\forall x(\phi{\leftrightarrow}\psi)$, so (IdT) entails (IS), which entails Harmony by the Indiscernibility of Identicals.

A new argument for IS

There are some major points we can draw from Leonard 2021a:

- good explanations should not need to be further explained
- identities do not need to be further explained
- necessary truths must be explained
- if φ entails ψ, then φ explains ψ (if ψ does not entail φ)

Suppose you accept these claims.

Question

Is IdT, and thus IS, the only *good explanation* of Harmony?

Radical Supersubstantivalism

> ## Question
>
> Are there *good explanations* of Harmony that *do not* require endorsing IS and thus Modest Supersubstantivalism?

Currently, there are two proposals in the literature:

- Leonard 2021b's Mereo-Geometrical Theory
- Calosi 2022's Inheritance Theory

Mereo-Geometrical Theory

Leonard 2021b proposes a new theory because he puts forward the following desiderata for a theory of location T:

D1) T is consistent with contingent location

D2) T is consistent with two material objects having the same location

D3) T entails G-Harmony

D4) T entails P-Harmony

IdT clearly violates D1-2.

Therefore, Leonard 2021b proposes the Mereo-Geometrical Theory of location:

$$(\text{MG}) \quad \lambda xy(xLy) \;\equiv\; \lambda xy(Gx \leftrightarrow Gy \;\wedge\; \forall z(z \circ x \leftrightarrow z \circ y))$$

Mereo-Geometrical Theory

$$\text{(MG)} \quad \lambda xy(xLy) \ \equiv \ \lambda xy(Gx \leftrightarrow Gy \ \wedge \ \forall z(z \circ x \leftrightarrow z \circ y))$$

(MG) satisfies D1-3 and D4 – i.e., entailing P-Harmony – only given $\forall z(z \circ x \rightarrow z \circ y) \ \rightarrow \ x \leqslant y$.

But Anti-symmetry of parthood would entail that $x = y$ and (MG) would collapse to a form of IS.

Therefore, Leonard 2021b must reject the Anti-symmetry of parthood (which he does).

Inheritance Theory

Calosi 2022 defends another account of Harmony: the Inheritance Theory.

(InT)   (Geometrical-Inheritance) $\wedge$ (Parthood-Inheritance)

(G-In) $\lambda x(Gx \wedge Mx) \equiv \lambda x(\exists y(xLy \wedge Gy))$

(P-In) $\lambda xy(x \leqslant y \wedge Mx \wedge My) \equiv \lambda xy(\exists zv(xLz \wedge yLv \wedge z \leqslant v))$

As Calosi remarks, InT entails that (i) *shape* and (ii) *mereological structure* are <u>extrinsic</u> to material objects.

Overall evaluation - Benefits

MGT

① satisfies D3-4 (by entailing Harmony)

② satisfies D1 (consistency with contingent location)

③ satisfies D2 (consistency with two material objects having the same location)

④ provides an analysis of location

InT

Overall evaluation - Benefits

MGT

1. satisfies D3-4 (by entailing Harmony)

2. satisfies D1 (consistency with contingent location)

3. satisfies D2 (consistency with two material objects having the same location)

4. provides an analysis of location

InT

1. satisfies D3-4

2. satisfies D1, since InT is not committal about what location is

Overall evaluation - Benefits

MGT

1. satisfies D3-4 (by entailing Harmony)

2. satisfies D1 (consistency with contingent location)

3. satisfies D2 (consistency with two material objects having the same location)

4. provides an analysis of location

InT

1. satisfies D3-4

2. satisfies D1, since InT is not committal about what location is

3. metaphysically explains what it is for a material object to have a (i) shape and (ii) a mereological structure

Overall evaluation - Costs

MGT	**InT**

MGT

① rejects Anti-symmetry of parthood

InT

① shape is not an intrinsic feature of material objects (this view has been defended several times, see e.g., Skow 2007, Schaffer 2009 and Lehmkuhl 2018)

Overall evaluation - Costs

MGT

1. rejects Anti-symmetry of parthood

InT

2. mereological structure is not an intrinsic feature of material objects

Overall evaluation - Costs

MGT

1. rejects Anti-symmetry of parthood

InT

2. mereological structure is not an intrinsic feature of material objects

3. rules out relevant cases of two material objects having the same location (see later)

Varieties of Supersubstantivalism
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Explanations of Harmony
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Overall evaluation
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A new theory
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References
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Overall evaluation - Costs

③ InT rules out relevant cases of two material objects having the same location

Assume that to be a material object is to be located at a space-time region.

Then InT is inconsistent with a and b being such that:

- a and b are material objects
- a and b have the same location
- at least one material object is *not* part of the other

Overall evaluation - Costs

(P-In) $\lambda xy(x \leqslant y \wedge Mx \wedge My) \equiv \lambda xy(\exists zv(xLz \wedge yLv \wedge z \leqslant v))$

(P-In) entails ($\forall$P-In), that is:

$$\forall xy(x \leqslant y \wedge Mx \wedge My \leftrightarrow \exists zv(xLz \wedge yLv \wedge z \leqslant v))$$

By contraposition, ($\forall$P-In) is equivalent to:

$$\forall xy(\neg(x \leqslant y \wedge Mx \wedge My) \leftrightarrow \neg\exists zv(xLz \wedge yLv \wedge z \leqslant v))$$

(1)	$Ma,\ Mb,\ b \nleqslant a \quad aLr,\ bLr$	Ass.
(2)	$\neg\exists zv(aLz \wedge bLv \wedge z \leqslant v)$	($\forall$P-In):1
(3)	$r \leqslant r$	Reflexivity
(4)	$\exists s(aLs \wedge bLs \wedge s \leqslant s)$	1,3

You may want to avoid the previous argument for either of the following reasons.

Consider the following models, where:

- lines represent $\leqslant$ from bottom to top (implicitly reflexive)
- dashed lines represent L from top to bottom
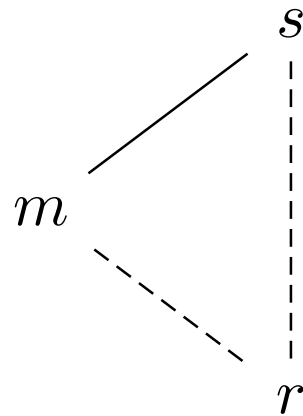
The statue s and its matter m have the same location but are not mutual parts.
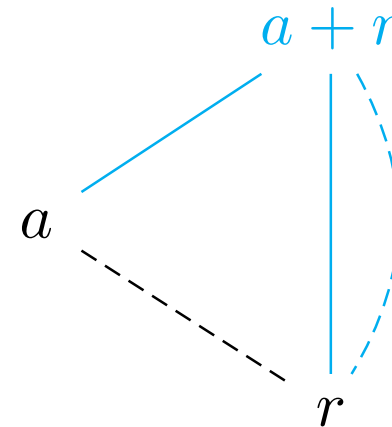
a and the fusion $a + r$ have the same location but are not mutual parts.

Varieties of Supersubstantivalism
OOOOOOOOO

Explanations of Harmony
OOOO

Overall evaluation
OOOOOOOOOO●O

A new theory
OOOOOOOOOO

References

Overall evaluation - Costs

③ **InT** rules out relevant cases of two material objects having the same location

If you accept InT, the only way to make InT consistent with *two* objects having the same location is to accept that:

- distinct objects can be mutual parts,
  thus rejecting Anti-symmetry of parthood.

Overall evaluation - Costs

MGT

1. rejects Anti-symmetry of parthood

InT

2. mereological structure is not an intrinsic feature of material objects

3. rules out relevant cases of two material objects having the same location,

   or

   rejects Anti-symmetry of parthood

Desiderata

Suppose you endorse Radical Supersubstantivalism and would like to have

1. a good explanation of Harmony which does not entail Modest Supersubstantivalism

And you want this explanation to be:

2. consistent with contingent location
3. consistent with different objects having the same location
4. consistent with Anti-symmetry of parthood

Neither MGT, nor InT, can jointly satisfy these desiderata.

Should you give up explaining Harmony? No.

A new theory

I propose you endorse the following account of location, i.e. Higher-order Harmony:

(HH) $\lambda xy(xLy) \equiv \lambda xy(Gx \leftrightarrow Gy \ \wedge \ \forall zv(z \leqslant x \wedge zLv \rightarrow v \leqslant y))$

By the logic of higher-order identity, (HH) entails Harmony.

Moreover, (HH) is an identity, so it is a good place to stop asking for further explanations.

(HH) also does not entail Modest Supersubstantivalism, i.e., the view that all the properties of material objects are held directly by their locations.

① ✓: (HH) is a good explanation of Harmony

Assuming our diagram/models make true G-Harmony, the models ruled out by HH are all the diagrams that contain the following type of diagram:
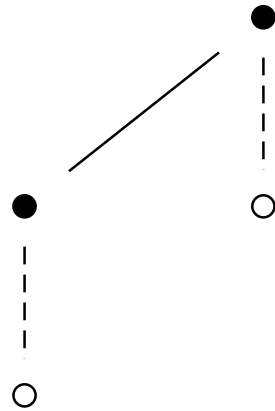
Thus, (HH) is consistent with contingent location, as long as the parts of a composite that changes its location change their location to regions that are parts of the composite's new location.

② ✓: (HH) is consistent with contingent location

Higher-order Harmony

Consider the following models :
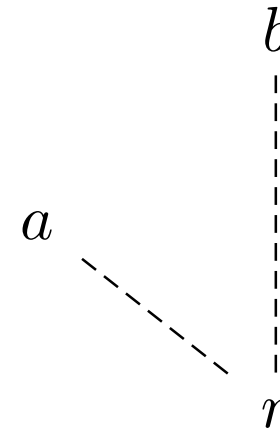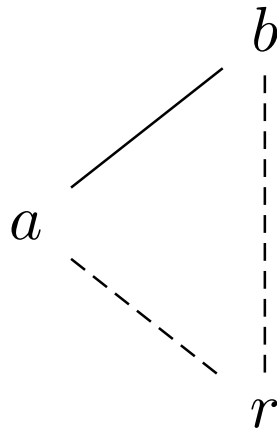
Both make true ($\forall$HH), so we can assume they make (HH) true. Therefore, (HH) is consistent with two material objects having the same location, even if one of them is not part of the other.

③ ✓: (HH) is consistent with *two* material objects having the same location

Higher-order Harmony

Consider the following facts:

- (HH) does not need to reject Anti-symmetry of parthood to (i) avoid entailing IS, or (ii) entail Harmony, unlike MGT
- (HH) does not need to reject Anti-symmetry of parthood to be consistent with relevant cases of co-location of different material objects, unlike InT

Therefore, we can maintain Anti-symmetry of parthood in our mereology together with (HH).

④   ✓: (HH) is consistent with Anti-symmetry of parthood

Overall evaluation

HH

1. satisfies all four of Leonard 2021b's desiderata

2. does so while being consistent with Anti-symmetry of parthood

HH

1. does not provide an analysis of location

2. does not metaphysically explain what it is for a material object to have a (i) shape and (ii) a mereological structure

? Is HH more informative than Harmony?

? Is HH circular?

Overall evaluation

? Is HH more informative than Harmony?

A possible objection to the informativeness of HH:

1. T1 and T2 explain p and q by entailment
2. p and q are not sub-formulas of any formula in T1
3. T2 $= \{p \wedge q\}$
4. HH is only as informative as T2 (mutatis mutandis)

One can resist this objection:

1. $\{p, q\}$ is equivalent to T2,
2. but Harmony is not equivalent to HH.
3. Harmony is consistent with the higher-order *difference* between Location and Harmony.
4. So HH rules out a possibility which is not ruled out by Harmony and thus HH is more informative.

Overall evaluation

? Is HH circular?

A possible objection: HH is not a good explanation of Harmony because it is a circular account of location.

The circularity comes from having the location relation on both sides of the higher-order identity.

I want to make two remarks on this issue.

1 HH is certainly not circular *as an explanation of Harmony*, since Harmony does not entail HH

2 We can answer in two ways:

    a) reformulate (HH) to avoid circularity
    b) accept the circularity and argue that it is *not* vicious

Overall evaluation

a) reformulate (HH) to avoid circularity

Drawing on InT, we might refine our previous formulation of (HH) to avoid objections of circularity:

$$(HH^*) \quad \lambda xy(Mx \wedge xLy) \equiv \lambda xy(Gx \leftrightarrow Gy \wedge$$
$$\forall zv(z \leqslant x \wedge zLv \rightarrow v \leqslant y))$$

If you allow things which are not material objects to be located somewhere (e.g. self-located regions), then HH* will not collapse to HH.

HH* will then explain location restricted to material objects in terms of unrestricted location, which are two different notions.

Overall evaluation

b) accept the circularity and argue that it is *not* vicious

Suppose you want to say a certain concept is analytic, or constitutive, of another – e.g. to be rational is part of what it is to be human. In higher-order terms: $\lambda x(Hx) \equiv \lambda x(Ax \wedge Rx)$.

Now, it makes sense to ask if a principle is analytic of a concept – e.g. Is Weak-Supplementation analytic of parthood? If yes:

$$\lambda xy(x \leqslant y) \equiv \lambda xy(... \wedge \ x < y \ \to \ \exists z(z < y \wedge z \varnothing x))$$

The above claim is circular, but does not seem *viciously* so.

We might thus argue that HH* is circular but not viciously: what it says is just that Harmony is constitutive of location.

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