Intrinsicness and Spacetime

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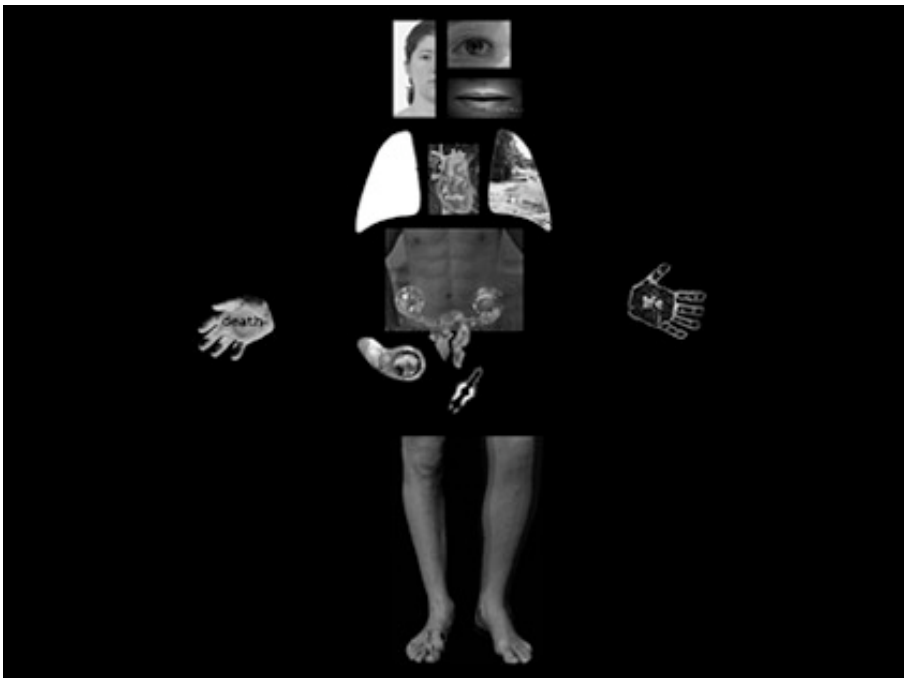
Lunedì 12 marzo 2007

Abstract

An intrinsic property, intuitively, is a property that a thing has in virtue of the way it is in itself. Clear and simple as the notion seems at first blush, it has turned out to be surprisingly difficult to define an extensionally adequate and philosophically fruitful notion of intrinsicness. I will show how this intuition first became fleshed out in the work of Jaegwon Kim and how Kim's account was criticised by David Lewis who subsequently proposed three different accounts of intrinsicness. I will identify the main shortcoming of Lewis' most recent redefinition and its predecessors: the existing definitions do not allow us to capture the intuitively basic and philosophically fundamental conceptual connection between intrinsicness and parthood. There are two different conceptions of "loneliness" at play in the definitions, and it is important to keep them apart. Properties had by a thing in virtue of the way it is in itself include properties it has in virtue of having such-and-such parts and properties it has in virtue of being so-and-so located within space-time. Whenever conversely some thing is part of another thing, there is a region of intrinsic match shared by both. Building on ideas of Stephen Yablo, I will try to remedy this weakness of earlier definitions and propose a new one.



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An intrinsic property is a property a thing a has in virtue of the way it is in itself; the world outside a cannot influence a's having its intrinsic properties; the fact that a either has or lacks the property in question is a fact just about a alone; intrinsic properties are those that characterise things directly, not via their relations to other things: they are local and internal and do not depend on what is going on outside a. Helping ourselves to the notion of a duplicate, a perfect copy of some thing a distinguishable from a only by its relations to other things, we can characterise an intrinsic property of a as a property had by all the duplicates of a. The duplicates of a, on the other hand, are just those particulars that share their intrinsic properties with a.

1 The Lewis definitions

This, however, is just a start: we would like to have a *criterion* for intrinsicness which gives us these results. Jaegwon Kim (1982: 59–60, 184), building on Chisholm (1976: 127), qualifies a property as intrinsic iff it is compatible with loneliness, i.e. can be had by something that is unaccompanied by any wholly distinct contingently existing thing. Lewis (1983a) remarked that this definition falsely classifies *being lonely* as intrinsic and went on to propose another definition:

Definition 1 (Lewis$_1$-intrinsicness)**.** *F is intrinsic iff for all x and y, if x and y have the same natural properties, then Fx iff Fy (Lewis 1983b: 26).*

Lewis (1986: 60) tentatively suggested that the natural properties could be characterised as a minimal supervenience base for any properties whatsoever.

Together with Rae Langton, Lewis proposed another definition in 1998:

Definition 2 (Lewis$_2$-intrinsicness)**.** *A property F is intrinsic iff for all x and y, if x and y have the same pure, non-disjunctive and non-co-disjunctive properties independent of loneliness and of accompaniment, then Fx iff Fy (Lewis and Langton 1998).*

A property is pure iff its exemplification does not imply the existence of anything else than the thing exemplifying it. Something is accompanied iff it does not coexist with a contingent wholly distinct thing and it is lonely iff it coexists only with its proper parts (if it has any). A property is independent of loneliness (accompaniment) iff it is both possible that is is had and that it is lacked by a lonely (accompanied) thing. A property is *disjunctive* iff it can be expressed by a disjunctive predicate but is not natural and much less natural than either of its disjuncts. The pure, non-disjunctive and non-co-disjunctive properties independent of loneliness and accompaniment are called "basic intrinsic" by Lewis and Langton. Def. 2 says that a property is intrinsic iff it supervenes on basic intrinsic properties, or, equivalently, iff it never differs between duplicates (where two things are duplicates iff they have the same basic intrinsic properties).

An analoguous definition of "basic intrinsic relations" gives us a notion of intrinsicness for relations:

Definition 3 (Lewis$_2$-intrinsic Relations)**.** *A relation is intrinsic iff it supervenes on the basic intrinsic properties of its relata and their basic intrinsic relations.*

If we call two pairs $\langle x_1, x_2\rangle$ and $\langle y_1, y_2\rangle$ "duplicates" iff x_1 and y_1 are duplicates, x_2 and y_2 are duplicates and x_1 stands in the same basic intrinsic relations to x_2 than y_1 does to y_2, then a relation is intrinsic iff it does not distinguish duplicate pairs. Among the intrinsic relations, we may distinguish those that only depend on the properties of their relata from those that also depend on their basic intrinsic relations:

Definition 4 (Internal and external relations)**.** *A relation is internal iff it supervenes on the intrinsic (and hence the basic intrinsic) properties of its relata.*[1] *A relation is external iff it it intrinsic but not internal.*[2]

[1] Lewis (1986: 62) calls an internal relation "intrinsic to its relata" (cf. also Lewis 1983b: 26, n. 16).

[2] Lewis (1983b: 26, n. 16) calls such a relation "intrinsic to its pairs".

Lewis and Langton (1998: 130) prove that every internal relation is intrinsic and that it is possible that not every intrinsic relation is internal. Lewis and Langton (1998: 129) mention spatio-temporal distance relations as intrinsic relations which are not internal (supervening on the duplication of pairs but not on the duplication of the relata taken separately). Other examples of external relations arise if a fusion $x \oplus y$ may have basic intrinsic properties F had by neither x nor y. Any relation between the parts supervening on such properties of the whole (e.g. *being such as to compose a fusion with property* F) will be external.

The impossible and the necessary property are not basic intrinsic because they cannot be lacked, hence they cannot be lacked by lonely or by accompanied things. They are, however, intrinsic because they supervene on anything whatsoever.

Lewis and Langton (1998) defined intrinsicness as a non-relational property of properties; intuitively, however, an intrinsic property is a property which exclusively characterises *the entities by which it is exemplified*. This feature may vary among the exemplifications of the property in question.[3] It therefore seems advisable to take "intrinsic" not to be a second-order property, but a relation between properties and individuals:

Definition 5 (Local version of Lewis$_2$-intrinsicness)**.** *A property is intrinsic to* a *iff it does not differ between duplicates of* a*.*

Not any property intrinsic to some thing is intrinsic *tout court*. *Being such that there is a cube*, e.g., is intrinsic to cubes, though certainly not intrinsic *tout court* (Marshall and Parsons 2001: 349, n. 2). Properties intrinsic to a are closed under negation and conjunction (and hence disjunction).[4] Properties that are had by a and are intrinsic to a are had by a *intrinsically*. As Dunn (1990: 183) urged, the class of properties had by a intrinsically is closed under implication.[5] Properties intrinsic to all particulars or, equivalently, had intrinsically by all their exemplifications, are intrinsic *tout court*.[6] The local definition gives us the same result for essential properties the global one gave us for the necessary property: if we assume that duplicates are counterparts, properties had by all counterparts of a thing do not distinguish between its duplicates.

There are at least four main problems with the Lewis/Langton account:

1. haecceitistic properties (the exemplification of which implies the existence of particular individuals) are not independent of accompaniment (Dunn (1990: 186), Sider (1996: 4), Humberstone (1996: 240) and Yablo (1999: 487)): they are had in only one world if particulars are world-bound.
2. properties involving relations across possible world (*having a duplicate in the world in which one exists* and *being a duplicate of Kofi Annan's*) are independent of accompaniment and non-disjunctive and are falsely classified as intrinsic.
3. disjunctive properties: *being such that there is a cube* is independent of accompaniment and falsely classified as intrinsic (Marshall and Parsons 2001: 3) if it is non-disjunctive, i.e. not much less natural than either *being a cube* or *being accompanied by a cube*. But Lewis and Langton (2001: 354) bite the bullet.
4. maximal properties (Sider 2001): A property F is *maximal* iff, roughly, large parts of an F are not themselves F. If *being a rock* is maximal, it has intrinsic duplicates which fail to be rocks because

[3] Sider (1996: 3) claims that *being green or being 10 feet from some red thing* is an intrinsic property (only) of green objects.

[4] Proof: Let P be a property intrinsic to a. If $\neg P$ would differ between duplicates of a, there were two duplicates of a, b such that Pb and c such that $\neg Pc$. If two duplicates of a would differ in $P \wedge Q$ (or in $P \vee Q$), they had to differ in either P or Q, which is impossible if P and Q are intrinsic to a.

[5] Proof: Let P a property that a has intrinsically. Assume $\vdash P \rightarrow Q$. Any duplicate of a has P and thus Q; so Q does not differ between duplicates of a.

[6] Proof: A property P is intrinsic iff it does not differ between duplicates, i.e. iff $\forall x, y(\mathrm{Dupl}(x, y) \rightarrow (Px \leftrightarrow Py))$. This means that it is intrinsic to all particulars. Because duplication is symmetric, $\forall x, y(\mathrm{Dupl}(x, y) \rightarrow (Px \leftrightarrow Py))$ is equivalent to $\forall x, y(\mathrm{Dupl}(x, y) \rightarrow (Px \rightarrow Py))$. By commuting antecedents, we get $\forall x, y(Px \rightarrow (\mathrm{Dupl}(x, y) \rightarrow Py))$, which means that P is had intrinsically by all its exemplifications (cf. Humberstone 1996: 228). If we imagine the realm of (actual and possible) objects partitioned in duplication classes, an intrinsic property is one that does not divide any duplication class. Properties intrinsic *tout court* are closed only under negation.

they are parts of rocks. So *being a rock* is extrinsic. As it is independent of accompaniment, however, Lewis has to claim that it is disjunctive, which does not seem very plausible. He is, however, prepared to bite the bullet (Lewis 2001: 382).

Lewis (2001: 387) proposes a less permissive criterion for 'bad disjunctions' (properties expressed by disjunctive predicates which are not intrinsic): a property is (badly) disjunctive iff it is equivalent to a disjunction such that each disjunct is more natural (not: much more natural) than the whole disjunction. He also makes a new attempt to characterise bad disjunctions directly, thereby cutting down his reliance on contentious judgements of comparative naturalness. The new definition runs as follows:

Definition 6 (Lewis$_3$-intrinsicness)**.** *A property P is intrinsic iff (i) P is independent of accompaniment, (ii) P is at least as natural as ($P \wedge$ being accompanied), (iii) P is at least as natural as ($P \wedge$ being lonely), (iv) $\neg P$ is at least as natural as ($\neg P \wedge$ being accompanied), (v) $\neg P$ is at least as natural as ($P \wedge$ being lonely).*

The Lewis$_3$-definition fares a little better with respect to maximal properties: it allows us to count *being a rock* as extrinsic not in virtue of its being the property expressed by the the negation of the supposedly "bad" disjunction *being not intrinsically rock-like or else intrinsically rock-like but embedded in some more inclusive rock-like thing* but because *being a rock and being lonely* is more natural than *being a rock* – the former applying to all and only intrinsically rock-like lonely things, the latter not applying to things that are not rocks but would be rocks if they were not embedded within rocks.

Def. 6 is a specialisation of the "general independence principle" defended by Weatherson (2001: 371): if F and G are intrinsic, then they are not only independent of accompaniment, but equally independent of F- and G-accompaniment respectively.[7] If we take, following Lewis (2001: 383), the general independence principle to be a necessary condition on intrinsicness, *being such that there is a cube* can be excluded from the class of intrinsic properties by imposing closure under negation (Weatherson 2001: 373): *not being such that there is a cube* or, equivalently, *being neither a cube nor accompanied by a cube*, cannot be exemplified by something accompanied by another thing exemplifying *being such that there is a cube*.

2 Parthood-dependent properties

If a part of me is intrinsically F, it is clearly an intrinsic property of me that I have an F part. Do the Lewis-definitions give us this result? It is not clear that they do. In order to be Lewis$_1$-intrinsic, not only F but also *having an F-part* would have to supervene on natural properties – but clearly, it also depends on mereological composition which is not itself natural. A non-disjunctive and pure part-directed property *having an F-part* of a is basic-intrinsic$_2$ to a iff the following four are possible:

(i) (a counterpart of) a is lonely and has an F-part
(ii) (a counterpart of) a is lonely and does not have an F-part
(iii) (a counterpart of) a is accompanied and has an F-part
(iv) (a counterpart of) a is accompanied and does not have an F-part

Apparently irrelevant considerations will decide the case: suppose I have a heart that intrinsically weighs 5 kg. Then I intrinsically have a 5 kg part. But could I be lonely and fail to have a 5kg part? It seems not.

Call a property "whole-directed" if is can only be had by things that are proper parts of something (e.g. *being a proper part of an F*). On Lewis' definition, all whole-directed properties come out extrinsic: If we accept the subtraction principle, i.e. that, if a is a proper part of b, then they have a mereological difference (the common part of all things overlapping b but not overlapping a exists), whole-directed

[7] F is independent of G-accompaniment iff all of the following are possible: (i) some F is lonely, (ii) some $\neg F$ is lonely, (iii) some F is accompanied by a G, (iv) some $\neg F$ is accompanied by a G, (v) some F is accompanied but not by a G, (vi) some $\neg F$ is accompanied but not by a G.

properties are not compatible with loneliness and hence extrinsic, independently of where F falls on the intrinsic/extrinsic divide. This is a result we may well wish to avoid.

Another objection, which applies also to Lewis' new account, has been put forward by John Hawthorne (2001). Take any binary relation R which may hold between a thing and one of its proper parts and consider its existential derivative $\lambda x(\exists y(xRy))$. This property is independent of accompaniment – so it either fails the tests of comparative naturalness of def. 6 or else is Lewis$_3$-intrinsic. If there are perfectly natural relations R the existential derivative of which is independent of accompaniment, however, it is very hard to see how $\lambda x(\exists y(xRy))$ could be more natural than or even as natural as $\lambda x(\exists y(xRy \wedge x \text{ is lonely}))$ or $\lambda x(\exists y(xRy \wedge x \text{ is accompanied}))$ (Hawthorne 2001: 401). So any such property *standing in* R *to something* will come out intrinsic – which, again, seems the intuitively wrong result.

It is interesting to note in this respect that Vallentyne's diagnosis of the problem cases, extrinsic disjunctive properties independent of accompaniment, differs from that of Lewis and Langton:

> "The problem [...] is that [the definition of Kim-intrinsicness] is formulated in terms of logical independence (compatibility), and this fails to capture the relevant notion of independence. [...] It fails to capture the idea that an object can cease to be the only red object in the world by the "mere addition" of a red object to the world." (Vallentyne 1997: 211)

Vallentyne (1997: 212) thus proposes to classify those properties as intrinsic that are such that neither they nor their negations would be lost if their exemplifications were inhabitants of a maximally contracted world (a world as small as possible while still containing the exemplifying particular):

Definition 7 (Vallentyne-intrinsicness)**.** *F is intrinsic iff for any world w, time t and object x, iff Fx ($\neg Fx$) at t in w, then Fx ($\neg Fx$) in each x-t contraction of w, where an x-t contraction of w is a world intrinsically identical to w but with all times other than t, all places not occupied by x, all things other than x and all laws of nature removed.*

Taking "contraction" seriously, Vallentyne in effect identifies intrinsic properties as those that are shared between a thing and the (mereologically) smallest intrinsic duplicate of that thing. Lewis and Langton (1998: 132) have shown that what they take to be the essence of Vallentyne's definition, that a property is intrinsic iff it never differs between a thing and a lonely duplicate of that thing, is equivalent to their own definition (2), provided that we assume that every thing has a lonely duplicate.

There is an important difference, however: Parthood relations, as Hawthorne has shown, are misclassified by the Lewis$_3$-definition, but come out as Vallentyne-extrinsic in just those cases in which they should. The reason for this is that the actual truthmaker of the existential generalisation comes to play a role: it is not enough, as it was for Lewis, that the existential generalisation *could* be made true by something outside and by something inside the thing. If is actually made true by something outside, then it is lost in Vallentyne's x-t contraction and hence extrinsic.

There is a refinement of Vallentyne's definition by Stephen Yablo which is not equivalent to the Lewis/Langton definition:

Definition 8 (Yablo-intrinsicness)**.** *A property F is intrinsic to a iff it cannot be lost or gained by adding a part to the world containing a. (Yablo 1999: 482)*

3 Neighbourhood-dependent properties

Shape-properties are usually taken as paradigmatically intrinsic properties:

> "If we know what shape is, we know that it is a property, not a relation." (Lewis 1986: 203)

This, however, appears problematic: the shape of a thing surely depends on the gravitational field around it and this is not just a matter of how the thing is itself.

This is even more drastic with distance relations that are supposed to come out intrinsic under the Lewis_2-definition. Lewis (1986: 62) subscribes to what Bricker (1993: 277) calls the "intrinsic conception" of space: spatial distance is intrinsic to the points in space it relates. Duplication of points, on this conception, implies congruence, i.e. preservation of all distance relations; congruence implies duplication with respect to spatial properties. This contrasts with the "Gaussian conception", which measures distance between points by the greatest lower bound of the lengths of continuous paths between them. On this conception, isometric parts of space are spatial duplicates: distance supervenes on lengths of paths. Because isometry is weaker than congruence, proponents of the "intrinsic conception" disagree with the latter claim: they require congruence, not just isometry for duplication. According to Bricker (1993: 283), the Gaussian conception therefore denies that shapes are intrinsic. Even though the "intrinsic conception" is perhaps closer to common sense, Bricker has argued that it is not the conception embodied our best scientific theories: the differential geometry of general relativity is "Gaussian through and through" (Bricker 1993: 286). We can, however, develop a "local version of the Gaussian conception according to which the only primitive metrical notions are local properties of points" (Bricker 1993: 286) in the following sense:

Definition 9 (Bricker-locality)**.** *A property F is local iff, for any a and b, neighbourhoods A of a and B of b, if B is a duplicate of A and b is a (A, B)-duplicate of a, then Fa iff Fb (Bricker 1993: 289).*

b is a (A, B)-duplicate of a iff they are duplicates under a one-to-one correspondence of all parts of A with parts of B that preserves all perfectly natural properties and relations (Bricker 1993: 274). Bricker (1993: 289) calls local properties that are not intrinsic "neighbourhood-dependent" and claims that the local metric at a point is neighbourhood-dependent on the Gaussian conception.

But is it? Two considerations may make us doubt this. The status of a property as intrinsic or extrinsic depends, first, on the things that exemplify it. Even on the Gaussian conception, as Bricker (1993: 278) acknowledges, length is an intrinsic property of paths. It seems to me that on the Gaussian conception, paths are plausibly taken to be the basic entities making up space (and space-time). It takes "distance-within-a-surface" to be the *only* distance there is and is right, contra Bricker (1993: 293, n. 20), to call it "intrinsic distance", for it *is* intrinsic to the entities making up space (and space-time).[8] I therefore do not see the need to reify infinitesimal neighbourhoods in order to have (Gaussian) distance coming out intrinsic.[9]

There is, second, an independent motivation for allowing intrinsic properties to be "neighbourhood-dependent".

4 Structural counterpart relations to the rescue?

To have a's property *having an F part* (where a's part in question is intrinsically F) come out intrinsic, Lewis (1986: 61) included an isomorphism condition into his definition of duplicates: two things are duplicates iff they have the same basic intrinsic properties and there is an isomorphism between their parts preserving all their basic intrinsic properties and relations.[10] On this account, then, *having an F part*, for a basic intrinsic property F of a part of a, is classified as an intrinsic property of a.[11] If

[8] I therefore do not agree with Bricker (1993: 283) who criticises the Gaussian to take shape to be extrinsic: the relevant question is *intrinsic to what?* Bricker is right that they come out extrinsic to points (especially when these are given as points of a three-dimensional Euclidean space into which the relevant objects are embedded, as they are in Bricker's example): but it may still be (and indeed is) intrinsic to paths.

[9] Neither do we have to change, as Bricker suggests, differential geometry for "non-standard differential geometry" based on the non-standard analysis of Robinson (1974).

[10] I therefore think that the second clause in the (Lewis 1986) definition of duplication does real work and that it would be an error to treat it, as Taylor (1993: 82) does, as redundant.

[11] Proof: Assume $\lambda x(\exists y,z(x = y \oplus z \wedge Fy))$ differs between duplicates, say a (having it) and a' (lacking it). Because they are duplicates and F is basic intrinsic property of a part of a, a' has to have an F part. But then it has $\lambda x(\exists y,z(x = y \oplus z \wedge Fy))$.

we keep the Lewis$_1$-definition of intrinsicness, we then have the following: If x and y are duplicates and x has a part z then y has a part which is a duplicate of z. Although it saves the intrinsicness of *having an* F *part*, this principle seems false. Duplication of wholes does not require duplication of parts: some duplicates of a whole may compensate for a dissimilarity in one part by a dissimilarity in another.

Let us, following Bricker (1993: 274), call a counterpart relation between a and b that preserves all natural properties and relations of a and its parts a (a, b)-duplication relation. Such a (a, b)-duplication relation between a and b gives us a relation between their parts which is stronger than mere duplication: in order for a part b' of b to be a (a, b)-duplicate of a part a' of a, b' does not only have to be a duplicate of a', but also be related to other parts of b in a way similar to how a' is related to the other parts of a. This, I think, allows us to capture the conceptual connection of intrinsicness with parthood in the following sense: structural properties which are intrinsic to wholes are preserved by (a, b)-duplication; although the intrinsic nature of a whole could be the result of parts with different intrinsic properties (the combination of respective the parts 'cancelling out' their intrinsic dissimilarity), any similarity between wholes must nevertheless be *grounded in* similarities of their respective parts: the parts just have to be chosen coarse-grained enough. If two wholes a and b are similar in spite of the fact that their respective parts a_1 and b_1 (and a_2 and b_2) are dissimilar, but the dissimilarity of the respective pairs is cancelled out by their combination, the parts to consider are not a_1 and a_2 (b_1 and b_2 respectively), but $a_1 \oplus a_2$ (and $b_1 \oplus b_2$). Wholes having dissimilar parts are only dissimilar *tout court* if there is no such way of grouping their parts such that the dissimilarity is cancelled out in this way.

We thus have an independent motivation to call Bricker's "locality" "Bricker-intrinsicness".

Taking into account the close connection between intrinsicness and parthood also helps us to solve the problem raised by Sider. If there are maximal properties, this means that there is an ontological distinction to be drawn between what Achille Varzi (1997: 42) calls (topologically) "open" and "closed" entities, i.e. entities which include their boundaries and those that do not. Houses and rocks, if *being a house* and *being a rock* are maximal, are closed – the open counterparts of a house which are embedded in a larger house are not houses, for they lack (counterparts of) parts the original house had, namely its boundary.[12]

5 Two notions of loneliness

Intuitively, intrinsicness is closely bound up with parthood. A property is intrinsic iff it is entirely a matter of how a thing is by itself whether the thing has or lacks it. In all Lewis-definitions, "how a thing is by itself" is translated into "how a thing would be if it were lonely". This transition, however, is far from being mandatory: Another possible way to spell out the "by itself" clause, as Sider's examples show, is to count those features of a thing as intrinsic which are determined by what goes on inside its borders, i.e. on how its parts are and in what relations they stand. This point is well made by Humberstone:

> "...the idea of an intrinsic property is the idea of a property a thing has in and of itself: but *considering* a thing *in itself* is not the same as *supposing* the thing to be *by itself*." (Humberstone 1996: 229)

What parts a thing has equally is a matter of how a thing is by itself. And how a thing is by itself will depend on what parts it has. The dependence of intrinsicness and parthood is two-way: x is part of y

[12] It might be replied that the embedded counterparts too have that boundary, just as a *fiat* and not a *bona fide* boundary. This line of thought, however, is mistaken: Varzi (1997: 45–46) conclusively argued against taking fiat boundaries to be possible bona fide ones. When I cut a soap in half, I do not 'actualise' a boundary that already, as it were, was there before, but I bring into being a new object, at the same time destroying another: "...fiat boundaries are not the boundaries that *would* envelop the interior parts to which they are associated in case those parts were brought to light by removing the rest [...]. Wherever you have a fiat boundary, you can have bona fide boundaries. But the former never *turns* into the latter – at most, it *leaves room* for them." (Varzi 1997: 46)

iff there is a region of intrinsic match between x and y.[13] There is thus a strong presumption to have *having an* F *part* count intrinsic with respect to a whole that has a part which has F intrinsically – at least with respect to an explication of intrinsicness that preserves its connection with parthood. We already noted that Lewis' definitions do not fall in this class. The construal of intrinsicness as interiority, as Humberstone (1996: 239) calls it, is however clearly present in Vallentyne, Yablo and Dunn.[14]

I think it is useful to distinguish two concepts of loneliness:

loneliness as independence : x is lonely in this sense iff it exists all by itself, i.e. if nothing other exists than its (proper and improper) parts: $\forall y(y \leq x)$;

loneliness as interiority : x is lonely in this sense iff all things outside it are abstracted away and the thing is considered 'in isolation'.

6 Intrinsicness as substantiality

Yablo's definition of intrinsicness presupposes world-overlap, though only overlap of intrinsically perfectly similar world-parts, thereby avoiding Lewis' famous problem of accidental intrinsics. Assuming the existence of universals and the traditional conception that they are wholly present when- and where-ever they are exemplified, world overlap cannot be avoided anyway.[15]

In what way will our possible worlds overlap in virtue of universals? In just the way we need to define what it is for something to be a duplicate. Traditionally, a particular a is a substance iff it is possible that a exists independently. What, however, is independent existence? When is a particular a in a world w existing independently of anything else? Whenever there is no other particular existing in that world. For Lewis, as Humberstone (1996: 261, n. 28) has remarked, a lonely object *is* a possible world. Substances, in other words, are entities that are possibly worlds.

What relations between parts and whole are there? Because $x \oplus y = x$ iff y is part of x, any intrinsic relation between x and one of its parts y will automatically be internal. Let us distinguish, for any particular a, a's *intrinsic nature*, i.e. the fusion of all those properties it has intrinsically, from a's *extrinsic nature*, i.e. the fusion of those properties it has extrinsically. The intuition I want to work with is then the following: the intrinsic nature of something is a (non-spatiotemporal) part of it; the intrinsic nature of a part is then 'included' in the intrinsic nature of the whole. We could even use this inclusion of intrinsic natures to *define* what it means to say that y is part of x.

Because worlds, which I take to be maximal spatio-temporally interrelated wholes, are particulars, we can state our proposal thus:

Definition 10. *A particular a is a substance iff it is a counterpart of a world.*

(10) is intended to be neutral on what substances there are, e.g. on whether un-detached arms are substances or not. It does give us, however, a general characterisation of non-substances: Any particular x is not a substance iff x cannot exist but as proper part of something else.[16] Any substance has intrinsic properties and thus an intrinsic nature. We now have yet another pair of interdefinables:

[13] If x is part of y, x and a part of y are indiscernible, hence share their intrinsic properties. This is mirrored by the fact that the intrinsic properties F of x can be ascribed 'obliquely' to y under the form "has an F part" – which denotes an intrinsic property if F does.

[14] The last even helps himself to explicitly mereological terms: "Metaphysically, an *intrinsic* property of an object is a property that the object has by virtue of itself, depending on no other thing. Epistemologically, an intrinsic property would be a property that one could determine by inspection of the object itself – in particular, for a physical object, one would not have to look outside its region of space-time." (Dunn 1990: 178)

[15] This is explicitly acknowledged by Lewis (1983b: 11) who claims that we do not therefore have a problem analogous to the problem of temporary intrinsics for particulars, for universals do not have contingent intrinsic properties (Lewis 1986: 205).

[16] The distinction between substances and non-substances allows us to distinguish derivatively between two sub-species of the part/whole relation. In some cases, e.g. when we say that ethics is part of philosophy, the ontological dependence is two-way:

Definition 11. *A property F is the intrinsic nature of a substance a iff it is the fusion of all universals that are part both of a and of all counterparts of a which are worlds.*

Substances and intrinsic natures are intimately connected: a substance is a maximal spatio-temporally interrelated whole; an intrinsic nature is a maximal nonspatiotemporal part of a substance. Now, at least, we can define duplication:

Definition 12. *Two things are duplicates iff they have the same intrinsic nature.*

I think that this gives us the right results. A property F is intrinsic to a iff it does not differ between duplicates of a, i.e. iff is part of any substance which has the same intrinsic nature than a, i.e. iff it is part of the intrinsic nature of a. An extrinsic property, differing between duplicates a and a', is not part of their common intrinsic nature and thus differs between them and their lonely counterpart.

We now finally get the desired result. Suppose, for *reductio*, that *having a F part* is extrinsic for an intrinsic F of a part b of a. Then there is a world a' which is not only a counterpart of a, but also a duplicate, and which has no F part. So a' does not contain F. Because b has an intrinsic property, it is a substance, i.e. it has a counterpart b' which is a world. If a' would contain a counterpart b'' of b then b'' would have to be a counterpart of b'.[17] Being a counterpart of b', b'' would have F as part of its intrinsic nature. So a' cannot contain b'', so a and a' are not duplicates. So *having an F part* is intrinsic.

the whole generically depends on having *some* parts or other, the parts depend on there being a whole. No ethics without philosophy, no philosophy without there being philosophical disciplines. In other cases, we have generic dependence of the parts on the whole and specific dependence of the whole on the parts, e.g. when we say that the proposition that it rains is part of the argument "If it rains, I will be sad. It rains. So I will be sad." There would be no such argument if the proposition would not exist. The existence of the proposition, however, does not depend on any particular argument, but (perhaps) on there being arguments (at least of the trivial "If p, then p" form).

[17] I am assuming that any counterpart of a substance is a substance. This is justified because *being a substance* is essential to substances if anything is.

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