

Shadows of constitution *

(Forthcoming in *The Monist*, 2007, “Lesser Kinds”, eds. Roberto Casati and Achille Varzi)

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ABSTRACT. Mainstream metaphysics has been preoccupied by inquiring into the nature of major kinds of entities, like objects, properties and events, while avoiding minor entities, like shadows or holes. However, one might want to hope that dealing with such minor entities could be profitable for even solving puzzles about major entities. I propose a new ontological puzzle, the *Shadow of Constitution Puzzle*, incorporating the old puzzle of material constitution, with shadows in the role of the minor entity to guide our approach to the issues involved. I then analyze the standard answers to the original puzzle of constitution, in their role as potential solutions to the new puzzle. Finally, I discuss three views that can solve the proposed puzzle.

The old puzzle of material constitution has benefited from a lot of thorough discussion from the part of metaphysicians in the last thirty-odd years. The available solution options and their problems are by now familiar. They involve particular views on mainstream entities and relations of metaphysical inquiry, like objects, properties, events, causation, identity, supervenience, and so on. However, one might want to hope, together with some contemporary ontologists, most notably Roberto Casati and Achille Varzi (1994), that dealing with more peripheral entities is not without interest even when it comes to solving mainstream questions of metaphysics. This I am going to do here, with the puzzle of material constitution in the role of the mainstream ontological issue and shadows in the role of the minor, superficial, or peripheral entity.

1. The Constitution Puzzle

* For valuable feedback on earlier versions of this paper I am grateful to Laurie Paul, Fiona Macpherson, David Chalmers, an anonymous referee, and the members of the ontology reading group at the Australian National University, namely, Brendan Jackson, Jens Christian Bjerring, Carl Brusse, Jacek Brzozowski, Aidan Lyon, and Weng Hong Tang.

Let us start with a brief exposition of the puzzle of material constitution. The puzzle is usually put forth by way of examples, meant to create a tension between some intuitions we might have with respect to one and the same example. Consider the classic example of a statue that is made of a quantity of soft clay at time t_1 . At t_1 , we can agree, the piece of clay constitutes the statue. The question is, however, whether this relation is *sui generis* or the good old relation of identity. The puzzle comes from the fact that we have both an intuition of identity between the statue and the clay and an intuition of distinctness¹.

Suppose at time t_2 the clay is flattened against the ground. At t_2 , we can agree, the clay exists while there is no statue around. Flattening the clay is tantamount to destroying the statue. This may easily lead us to thinking that at t_1 the statue and the clay are distinct since they do not share all their properties. Given the principle of the indiscernibility of identicals, if two individuals differ in some property, they are non-identical. The statue and the clay differ in their *de re* modal properties, namely, the statue does not have the property of being able to survive flattening, while the clay does.

However, there is also an intuition that the relation of constitution is one of identity. Consider again the statue and the clay at t_1 . They occupy exactly the same spatial region. They have exactly the same parts. They share all their physical properties. Since they are physical objects it is very hard to think they are distinct. There are two kinds of rationale for thinking they are identical: positive and negative. The positive arguments are the ones I have just enumerated above. For example, the fact that they have the same parts is in agreement with a principle of stronger systems of mereology, that of extensionality, which states that individuals are identical if and only if they have all the same proper parts². If it is plausible that objects are just material occupants of space and time –the neoQuinean view-- then the mereological extensionality principle is also plausible, and, therefore, constitution as identity is motivated. Similar motivations for constitution as identity are obtained from the other facts about the statue and the

clay enumerated above. The negative arguments proceed from supposing that the relation between the statue and the clay is not identity and deriving some implausible consequences of it. Two such consequences are (1) that we would be driven to accept a kind of widespread and anti-Ockhamistic double counting when it comes to describing the material world, and (2) that there is an actual ground for distinguishing the statue and the clay, which is implausible if objects are just material spacetime occupants; and, indeed, why shouldn't they be such?

The solutions to the puzzle are such that they create two main camps: those who endorse the view that the relation between the statue and the clay is a brand new relation of constitution, not identity, and so there are two things present in the same region at t_1 , and those who endorse the view that the statue and the clay are identical and, therefore, there is only one thing present in the same region at t_1 . I will not review these solutions and their standard problems, but they will get discussed a bit later in their potential role as solutions to a new constitution puzzle I am going to propose shortly, after expounding some preliminaries to it.

2. Elements of shadow theory

The new puzzle I will propose will involve shadows. So in what follows I will briefly discuss some basic points about these minor or marginal entities.

Mentioning shadows as examples in various contexts is not foreign to mainstream metaphysical discussions, and, interestingly enough, shadows seem to be considered relevant precisely for part of the issues discussed in connection with our constitution puzzle. Shadows are proposed as counterexamples to Locke's thesis, according to which there cannot be more than one object in the same place at the same time, a thesis which, if plausible, would motivate our mereological extensionality principle³. The notion of shadow that is relevant here is that of a shadow cast on a surface, i.e. a two-dimensional entity. Let us formulate two possible accounts

of shadows. We will see that both are compatible with the falsity of Locke's thesis, though the accounts differ in their consequences for the extensionality principle. I will call the first the *Immaterial Constitution View* (ICV), and the second the *Material Exstitution View* (MEV).

The physical explanation of shadows is pretty straightforward; it involves no mystery. A shadow on a surface is the result of some opaque object blocking the way of light toward that surface, so the shadows are 'embodiments' of quantities of absent photons. Metaphysically, shadows possess some important distinguishing properties. First, they are immaterial, but concrete, meaning that they are not composed of matter, but they have location and duration. Second, they are ontologically dependent entities. What they depend upon is what we shall call their *source*. The source of a shadow is the quantity of light and the object, the *obtruder*, which stands in its way toward the surface where the shadow is located⁴. There is also a condition on the environment that has to be satisfied, which is a nonzero volume of space, for which it is true that light would have penetrated it, had it not been blocked by the obtruder. The relation between a shadow and its source is causal, the latter causing the former. At the same time, it is plausible to assume that the causal relation is necessary. For instance, there cannot be shadows without some source existing, e.g. in worlds with no light or in worlds with no opaque objects. So the dependence of shadow on its source is in fact the standard necessary ontological dependence. A consequence of this is that a shadow cannot *outlive* its source, which is, *prima facie*, a piece of commonsense. What I mean by a shadow outliving its source is captured by the following definition:

(D) A shadow outlives its source if and only if the shadow's lifespan is longer than that of its source.

I arrived to this definition by considering what the above piece of commonsense amounts to, namely, that the presence of a particular shadow is perfectly causally correlated with the presence of a thing that blocks some light, an obtruder. Given the very meaning of “blocking”, this entails equal lifespan for the shadow and its source. As a consequence, I think (D) does capture the idea of shadows’ ontological dependence on their sources. In section 4, I will consider some putative counter-examples to the thesis that a shadow cannot outlive its source, and show that they do not falsify the thesis. For now, let us assume that the thesis is true. The two accounts I have mentioned will approach differently the metaphysical consequences of these general features of shadows as far as the ontology of the shadows themselves is concerned.

According to ICV, shadows are standard spatial entities hosted by material surfaces, just like regions of material surfaces themselves, except that they are not composed of matter, but from missing light⁵. They are immaterially constituted by subregions of the region they cover. The mereology of shadows as so conceived is no different from the standard mereology of concrete material individuals. One might object that reference to light that is missing entails an error theory about where the folk locate the shadows, namely, that shadows are in fact where the light is, which is in itself quite hard to understand, but, more importantly, it makes it hard to see how shadows could literally be composed of their parts. But there is no such problem, in fact. Reference to missing light is essentially contrastive and counterfactual. When a shadow is located according to the folk at region A, there is light at some region B that does not overlap with A, and reference to the shadow has to mention both A and B, which would go something like this: there is a quantity of light that would have been *at-A-rather-than-at-B* had it not been blocked by the obtruder. Shadows will always be referred to as located where the folk locate them since their folk location is always an element of the contrast pair. Literal composition can then also be accounted for. For example, to say that shadow S, located at B, has a part S* is to say that there are quantities of light Q* and Q, a region $A^* \subseteq A$, and a region $B^* \subseteq B$, such that

Q would have been at-B-rather-than-at-A and Q* would have been at-B*-rather-than-at-A*, had they not been blocked by an obtruder.⁶

When it comes to Locke's thesis, since we assume that the shadows' individuation by and dependence on sources is common to both ICV and MEV, ICV will sanction both the insufficiency of spatial co-location and the insufficiency of sameness of parts for identity. The standard way to think of a counterexample to Locke's thesis involving shadows is by considering two distinct opaque objects and two distinct light beams, so that the light beams' direction of projection on these objects is such as to juxtapose each object's corresponding shadow on exactly the region occupied by the other. That there are two shadows in the same region is yielded by the fact that there are two distinct sources of them. To verify it, consider the case when one of the sources is halted, by turning off the light. There is still a shadow located in the same region. If there were not two shadows before halting one of the sources, then we should accept this case as one of the shadow's outliving its source, which is what we have taken as false for the moment. Therefore, there were two shadows in the same place at the same time. This is also a case against the principle of extensionality. According to ICV, both shadows have the same immaterial parts. Yet they are distinct.

Let us turn to MEV. According to this view shadows are spatially determined not by immaterial parts present in the subregions of the region they occupy, but by extraneous light, that is, by the configuration of light that delimits the region occupied by them. In this sense shadows are not constituted, but they are what we may call 'exstituted', determined by a certain collection of materially occupied regions outside them. The view will have the same thing to say about our counterexample to Locke's thesis. However, when it comes to extensionality, MEV will yield a different result. While it is true on this view that the two shadows are distinct and occupying the same region, they have distinct parts: they are exstituted by distinct quantities of light, coming from distinct light sources.

On both views Locke's thesis is false, on the condition of that shadows cannot outlive their source, but the mereological principle of extensionality is false only on ICV. However, as Roy Sorensen (1999: 30) correctly points out, the puzzlement regarding Locke's thesis diminishes once we recognize that the two-dimensionality of cast shadows is related to their being surfaces rather than to their being shadowy, as shadows can appear three-dimensional. For example, the shadow of the Earth is cast in empty space, and shadows can be cast into fog⁷. So if we focus on three-dimensional shadows, the above example of two sources determining coinciding two-dimensional shadows on a surface does not count against Locke's thesis; we have two distinct three-dimensional shadows that partially overlap, the region of overlap being the two-dimensional cast shadow.

At the same time, we may formulate an extensionality principle for any system of shadows, which will be true on both views, namely:

$$(\textit{Shadow Extensionality}) \forall z (Szx \leftrightarrow Szy) \leftrightarrow x = y.$$

Here Sxy means 'x is a source of y', and we can define shadowhood for an individual x generally as $\exists y Sxy$. The extensionality principle states then that shadows are identical if and only if they have the same source.

3. The Shadow of Constitution Puzzle

After this brief exposition of some elements of a potential theory of shadows, let me propound what I will call the *Shadow of Constitution Puzzle*, which is related to the classic constitution puzzle in that the latter is part of the former, so that it is not necessary that a solution to the latter is also a solution to the former. This makes the puzzle interesting and important, I believe,

because it reflects a case when an answer to a question involving a minor entity like the shadow is also an answer to a mainstream metaphysical puzzle.

Consider the case of the statue and the clay as usual when expounding the constitution puzzle. At t_1 , there is a statue s , made of some clay; or there is a piece of clay p , with the form of a statue. At t_2 , the clay is flattened, so that the statue s does not exist, while p exists. If at t_1 s 's shadow, s^* , is identical with p 's shadow, p^* , and with the shadow present at t_2 , s^{**} , then, at t_2 , s^* ($= s^{**}$) exists while its source s does not, which, according to our theory of shadows, is impossible. Finally, there are good reasons to believe both (a) that at t_1 there is only one shadow, s^* ($= p^*$), and (b) that $s^* = s^{**}$. As we can see, the puzzle is really a puzzle as long as the thesis that shadows cannot outlive their source is true. I will turn to this issue in the next section, but before that, let us further expound the reasons to believe (a) and (b), respectively.

(a) *Same Source Parts* \Rightarrow *Same Shadow*. At t_1 the statue and the clay share all their material parts. Being the source of a shadow is exclusively a matter of material properties of the obtruder and those of the environment, given a fixed source of light.⁸ But individuals sharing all their material parts at a time will intuitively share all their material properties at that time⁹, so they will be the same source for their shadow. Therefore, we can assert the principle *Same Source Parts* \Rightarrow *Same Source*. This, together with *Shadow Extensionality*, implies *Same Source Parts* \Rightarrow *Same Shadow*. So we have a single shadow at t_1 .

(b) *Persistence for shadows*. Shadows persist more easily than material individuals falling under sortals. The persistence conditions for shadows are most liberal. A rough but correct way of stating them is: a shadow persists through a certain time stretch if there is a constant lighting during that time stretch on some maximal spatiotemporally connected material individual that persists through that time stretch. A maximal spatiotemporally connected individual is a fusion

all of whose parts are arbitrarily spatiotemporally close to each other and which are not parts of anything else for which this is true. Note that I am only stating sufficient conditions for shadow persistence. Arguably, necessary conditions would be much harder to state, if at all. If this is the characterization of persistence conditions for shadows, then, regardless of one's view about the relation between the statue and the clay and about the number of things there are at the time when the latter constitutes the former, they will be satisfied by the hunk of matter in our example, so we can conclude that the idea of there being only one persisting shadow in our example is well motivated.

4. Can a shadow outlive its source?

A natural reply to the puzzle is to say that it is not a puzzle after all, because it is not at all obvious, though it is *prima facie* natural, that a shadow cannot outlive its source. In what follows I will argue that all the putative counterexamples to this thesis are really counterexamples insofar as they are tokens of the Shadow of Constitution Puzzle type. In other words, the thesis that shadows cannot outlive their sources is almost always true, except in cases structurally identical to the proposed puzzle case. If that is the case, then the putative puzzle is really a puzzle. As I have mentioned before, by definition, a shadow outlives its source if and only if the shadow's lifespan is longer than that of its source. The main published source of putative counterexamples to my thesis is a paper by Roy Sorensen (1999)¹⁰.

Consider first a tree that casts a shadow from the time it comes into being until after it petrifies; by petrifying the tree passes away, so we have the tree's shadow outliving its source.

But this is structurally the same as the proposed puzzle: petrifying here plays the role that flattening plays in the statue-clay case. In the statue-clay case we have the shadow apparently switching obtruders, from a statue-and-piece-of-clay to a piece of clay; in this case we have the shadow apparently switching obtruders, from a tree to a stone.

Next, consider the Sun illuminating the Moon in such a way that the latter casts a shadow on the Earth. Suppose the Moon suddenly disappears. Given the speed of light, the shadow on the Earth will last about a second more after the Moon disappears. But this does not show that the life span of the shadow is longer than that of its source. The shadow needed exactly the same time to come into being once the source had come into being as the time it lasts longer after the Moon disappears. Also, this doesn't even show that a shadow can outlive an obtruder, since the lifespan of the Moon *qua obtruder* is equal to that of the shadow. Sorensen says (p.30) that "If the Moon were further away, its shadow could last several minutes [after the Moon's vanishing, n.a.]. We can extrapolate to posthumous shadows that postdate their object by millions of years." He puts the example forward as one that falsifies the thesis he attributes to Samuel Todes (1975, 96) that "a shadow is sustained in existence by the continued existence of its originating source", which would naturally follow from the parasitic nature of shadows. However, I don't see why the example is supposed to falsify the thesis since a shadow's "postdating its object by millions of years" is not the same as the shadow's continued existence not being dependent on its object's continued existence: in order for the shadow to persist for millions of years it had to be the case that its object existed for millions of years. For suppose it were the same thing. Then it would follow, given that the speed of light is less than infinite, that it is absolutely impossible that the sustained existence of any shadow be dependent on the continued existence of its object since light requires time to travel any distance, so that at any time there is at least one temporal part of the shadow that is generated by a temporal part of an object that went out of existence. I gather Sorensen does not want to make such a claim. Therefore, what is meant, or should be meant, by

the thesis such that it would naturally follow from the parasitic nature of shadows is more or less what I mean by it given my definition of a shadow outliving its source. The petrifying tree is a counterexample to it (and the same as the proposed puzzle), but the Moon example is definitely not, so it is irrelevant.

Third, consider the speculation about an infinite past in which a shadow is sustained by a beginningless sequence of obtruders, each of which is obliterated and seamlessly replaced by another of the same shape and size. Now it looks that we have a shadow that *antedates* all its sources. The interpretation of the case –whether it is one shadow antedating some objects– depends, however, on one’s understanding of individuation and persistence for shadows. Recall that I stated the sufficient condition for shadow persistence as involving source *persistence*. In the example above the obtruders get constantly and seamlessly replaced by other obtruders, so the condition of source persistence is not satisfied since even if seamless, the replacement is still a replacement. This means that, to the extent that my criterion for shadow persistence is correct, we are not justified to think that we have one single shadow. Yet, you might take the example as showing that the source persistence criterion for shadow persistence is too strong, and that something less than source persistence is sufficient, namely, source spatiotemporal continuity. I think this is implausible. Consider the following case, which I take to be isomorphic to the above example. Instead of each obtruder in the infinite series being instantaneously destroyed and replaced by some other obtruder of the same size and shape, for each obtruder we have an object located within its shadow cone, i.e. completely shaded by the former, and whenever the obtruder is instantaneously obliterated, the shaded object instantaneously moves to its place, so that at the level of the shadow there are no noticeable changes. I think it is plausible to say that the previously shaded object has just become an obtruder when it moves to the place of the obliterated obtruder. But it is plausible to consider that an object’s becoming an obtruder is the

same thing as a shadow's coming into being. So it is plausible then that we have a new shadow for each obtruder in the infinite series.

Similar considerations apply to cases when there are two or more juxtaposed objects and one of them is obliterated¹¹: if the one that is obliterated was in causal contact with the light source, then it was an obtruder, and after obliteration the next one becomes an obtruder, that is, a new shadow comes into being; if the obliterated one had no causal contact with the light source, then it was not an obtruder to begin with, so the fact that we have a persistent shadow is due to the persistence of the obtruder that does not get obliterated.

However, there is a case that seems *prima facie* problematic: what if the infinite series of obtruders considered above is obtained not by replacement of whole obtruders, but by Ship of Theseus type gradual replacement of relatively tiny parts? It seems that I cannot reply, as before, that there is no obtruder persistence and so no justification for believing in the persistence of a single shadow, because there is clearly some persisting thing at any time, even though on a large scale we can identify an infinity of distinct objects. The reply to this is quite simple: it is a case structurally identical to what happens in the Shadow of Constitution puzzle. Indeed, it is very similar to the petrifying tree example: the role of petrifying is here played by gradual replacement of some quantity of matter.

Finally, let me also consider a case that attacks the thesis of a shadow's inability to outlive its source by challenging the thesis of ontological dependence of shadows on their sources. It is logically possible that an umbrella casts a shadow on a wall, suddenly disappears, and the shadow is still there. It is logically possible, the argument goes, because it is conceivable or imaginable. Indeed, I can imagine something like that. However, imagination in this case is not a guide to metaphysical possibility. It is not determinate what we imagined. On the one hand, we could have imagined the umbrella disappearing while its place being taken by an invisible or even immaterial object, a ghost obtruder of light¹². If this is the case, then the shadow cast by the

umbrella is distinct from the one cast by the ghost obtruder. On the other hand, we could have imagined that the umbrella disappears and nothing takes its place, yet light does not penetrate some empty volume, the volume that was previously filled by the umbrella. If the latter is the case, I would say two things. First, I stated the ontological dependence with reference to *light*. If something behaves as in this second imagined scenario, then that is not light, but rather *brzlight*,¹³ standard Kripke-Putnam insights apply here: it is something luminous, but it is not what we refer to by referring to light. Second, the imagined situation is not even on the same footing as imagining water as not being H₂O. The thought about water that is not H₂O is presumably in accordance with a folk conception of water, namely, as a transparent, drinkable, odorless, and colorless liquid. Brzlight, however, is quite far from the folk conception of light; arguably, the folk would regard as part of the concept of light that it penetrates empty space, i.e. there is no reason for it to not penetrate a volume if there is nothing to stop it.¹⁴

Finally, one might be worried that the puzzle is not really about parasitic immaterial beings as such, but rather about characteristic effects of objects¹⁵. Consider, for instance, a locomotive that is petrified in such a way that it continues to release its plume of smoke (maybe it is displayed as a curiosity). The same puzzle could arise in this case, it seems.

In reply, I should point out that shadows are, in fact, analytically connected to the obtruders, given the facts about the source of light. They are absences of light in some regions, and the absence of light in the shaded region is equivalent to the presence of an obtruder that blocks that quantity of light, given the facts about the presence of the light source and the meaning of “blocking”. A *particular* shadow is then present only in virtue of a *particular* obtruder, given the facts about the light source. The same is true of parasitic immaterial beings in general, like holes, for instance; the presence of a *particular* hole is ensured by the presence of a *particular* hole-host, and nothing else. This is distinctive of such beings. The locomotive’s plume

of smoke is not like that. There is no fact about the locomotive and some meaning fact about a term (like in the case of the term “blocking” above) such that the presence of functioning locomotives entails the presence of smoke.

Let me then conclude that the Shadow of Constitution Puzzle is indeed a puzzle, and move forward to considering some potential solutions to it.

5. Some answers to the puzzle

Let us then return to the puzzle and see whether the standard answers to the original constitution puzzle are of any use for solving our puzzle. I will analyze in what follows these answers and show that they are not solutions to our puzzle. The main cause of this failure is, I will argue, that the mere identity/nonidentity or one thing/two things divide does not seem to be relevant for this new puzzle. More precisely, I will argue that the puzzle remains unsolved regardless of whether one endorses identity or distinctness as the relation between the statue and the clay that constitutes it.

Nonidentity views simpliciter. Those who endorse the view that when the clay constitutes the statue there are two distinct objects¹⁶, the piece of clay and the statue, seem to be in the worst position vis-à-vis the shadow of constitution puzzle. Since when the clay is flattened the statue is destroyed, they will have to accept that the statue’s shadow, just like the clay, survives the destruction of the statue. As we have pointed out, the relation between the shadows of the statue and of the clay, respectively, is one of identity. The nonidentity view directly conflicts, therefore, with our intuition in the new puzzle, namely, that a shadow cannot outlive what it is a shadow of.

Identity views. So maybe the problem with nonidentity views is nonidentity, in which case identity views are expected to do better. But they don't. According to these views the statue is identical with the piece of clay, but contingently or occasionally so¹⁷: there are times when the clay is a statue and times when the clay is not a statue. This may well be a solution to the constitution puzzle, but how is it supposed to work for our puzzle? The fact that there is only one thing at t_1 , which is both a statue and a piece of clay, is of no help if it is still true that the statue does not exist at t_2 : its shadow does. The view could work if either the statue survived its own destruction or the flattening of the clay was not equivalent to the statue's destruction. The former is a contradiction in terms, the latter very implausible. However, the defender of the contingent identity view will reply that the two bad options I mentioned are present only if we worked with names for the statue and the clay as rigid designators, but the defender of the contingent identity view derives her intuitions precisely from supposing these names are not rigid, but nonrigid descriptions. Now the solution that nonrigid designation possibly offers to our puzzle is the following. We can assert that s^* is the statue's shadow insofar as its source is the denotation of the description 'the individual, whichever it is, which is a statue'. At the time when the clay is flattened this description is denotationless. Therefore, at that time, 'the shadow of the statue' is denotationless as well, so the shadow of the statue is absent precisely when the statue is. So it is not true that the statue's shadow outlives the statue. But this reply does not in fact work. In the statue/clay case the nonrigid designation approach is fit for and motivated by the fact that statues and pieces of clay have different persistence conditions. It is still true under the contingent identity view that the clay survives the destruction of the statue. This is reflected linguistically by the description 'the individual, whichever it is, which is a statue' being denotationless when the clay is flattened. However, shadows, as I argued in the section about them, do not have as strict persistence conditions as statues do. There is no shadow, however described, in our case that can be said to have been 'destroyed'. So for our shadow to be the shadow of the statue it is not

necessary to always be caused by an individual that can serve as a denotation for ‘the individual, whichever it is, that is a statue’. Therefore, the problem remains.

*Partial identity views.*¹⁸ One might think that the problem lies in the neoQuinean view of objects as bare spacetime occupants. One could argue that spatial and temporal mereology is not fit for objects, and say instead that objects have more than just spatial and temporal parts. L. A. Paul (2002), for instance, offers a view according to which objects are fusions of their qualitative, logical parts. Among these logical parts we find *de re* modal properties. When constitution takes place, we have, according to this view, two objects that overlap in all and only their spatial material parts, but differ in other logical parts, like modal properties. So the objects are partially identical in that they share all their spatial parts. Now this may count as a solution to our puzzle, namely, the defender of the view can say that at the time when there is a statue constituted by a piece of clay we indeed have one corresponding shadow, but it is not the shadow of the statue or of the clay, but the shadow of the common part of them¹⁹. This common part does not get annihilated when the clay is flattened, so the puzzle is solved. However, I think it is hard to accept the idea that shadow *s** is not the shadow of the statue, but only of part of it. Existence conditions for shadows depend only on material properties of their source, so if the part of the statue that has a shadow is the fusion of all its material parts, then I don’t see why not say that it is the shadow of the statue, since there is no other part of the statue that would at all be relevant for shadowhood. In other words, even if according to this view an individual’s having all the material properties of the statue does not qualify being the statue, its shadow still qualifies as the statue’s shadow. It is, therefore, still true that the statue’s shadow survives its destruction.

Similar observations apply to perdurance four-dimensionalism. Assuming both shadows and their sources perdure by having temporal parts, it is still true that at least one of the temporal parts of the statue’s shadow exists while the temporally corresponding temporal part of the statue

is absent. That is, even assuming perdurance, there should be a one-one correspondence between the series of temporal parts, from shadows to their source. As a solution to the constitution puzzle, the four-dimensionalist story consists in stating the existence of two distinct objects, two four-dimensional worms, sharing some of their temporal parts. But this is not enough to solve our puzzle, because the one-one correspondence between the shadow's temporal parts and those of the statue is not realized. The natural objection at this point is to involve the possibility that at the level of cast shadows we have two shadow-worms as well. I reply by emphasizing that the two worms view of material constitution is well motivated by what happens or could happen later to the individuals involved in the constitution relation, namely, that their careers come apart. Nothing like that at the level of shadows: there is no sense in which some shadow has a shorter career, I think. All the motivation for such a view could only come from what happens at the level of their sources.

As for Ted Sider's (1996) stage view of four-dimensionalism, it will be discussed in the next section for reasons that will be offered there.

Eliminative views. Another possible solution to our puzzle could be to get eliminativist about some kind of objects, e.g. statues, while recognizing the existence of others, e.g. pieces of clay. In that case our puzzle dissolves, because neither the statue, nor its shadow exists, while the clay and its shadow both persist through time. This, indeed, is a way to get rid of the problem, but it is I think hard to justify the nonexistence of the statue while accepting that of the piece of clay that is statuewise molded. In other words, it is more credible to be eliminative all the way, that is, about both the statue and the clay, than to eliminate just one of them.

6. Composition nihilism and persistence nihilism

The composition nihilist will solve the puzzle, or rather dissolve it, by denying what Michael Rea (1995) calls ‘the existence assumption’ of the constitution puzzle. The assumption states, for some F , (i) that there are F s, and (ii) that there are things that compose F s. The composition nihilist --e.g. Peter Unger (1979), Gideon Rosen and Cian Dorr (2002)-- will deny (i) for all substitution instances of F except when F is a simple (a proper partless individual), and will deny (ii) for absolutely all substitution instances of F .²⁰

In our case the assumption is embodied in the assertion that there are statues and pieces of clay. If instead one is a nihilist, she will say that we commonly talk about such entities, but strictly speaking assertions like ‘there are statues’ are false – there are only statuewise arranged mereological atoms. The nihilism-based solution to our puzzle should be obvious. There is no way now for any shadow to survive the destruction of anything, because nothing gets destroyed. The statue and the clay do not exist, while the statuewise and claywise arranged collection of simples persists at all times we considered, though not always statuewise arranged. So the shadow is a shadow of the collection of simples and cannot (and does not) at any time exist without them.

One might be tempted to think that nihilism is probably the only solution, because it seems to be the only way to refuse to take seriously the very way the puzzle is formulated. The puzzle is formulated on the existence assumption, stating the existence of F s, which yields, by the definition of F s, the essentialist assumption that an F cannot become a non- F . Nihilism escapes this essentialist consideration by denying the first step, the existence assumption. It is tempting to think then that the shadow of constitution puzzle can only be solved if somehow from your assumptions it follows that *nothing* is such that it goes out of existence at the time of the flattening.

But this is not so. The puzzle can also be solved if from your assumptions it follows that *everything* is such that it goes out of existence a the time of the flattening. This is a consequence

of Ted Sider's stage view of four-dimensionism. According to it, objects, including persons, are very short-lived stages of four-dimensional worms. Our puzzle is solved because everything in the world at t_1 , including shadows, is numerically distinct from everything at t_2 , including shadows. Since all the entities in the world are very short-lived stages, there is no shadow that outlives its source simply because there is nothing to outlive anything! I have chosen to include Sider's view in a different category than that of perdurance four-dimensionism because it is importantly different in certain respects. For what is important in connection with our puzzle, it cannot be argued against the stage view as applied to shadows that it is parasitic on its application to sources. Indeed, the stage view is simply and brutally applied to everything. I'm not sure that this is better than what I argued is problematic about the perdurance approach. Second, it is similar to composition nihilism in that in a way (though Sider would disagree with me) it is a *nihilist* view of persistence.

The main problem I think most of the people have with these solutions to the puzzle is their counter-intuitiveness. It is counterintuitive both that there are no composite objects and that there are extremely many objects each with an extremely short existence.

There is, however, a last option, which in my opinion is to be preferred.

7. Shadow reductionism about objects

The last option is what I call 'shadow reductionism about objects'. It is the view of objects as mere shadow casters. More precisely, the view would be that an object exists only if it is located in some spatial region r at some time t , casts a shadow at t if all other conditions (besides the one that the object be located at r) for casting a shadow are satisfied at t , and would coincide through any arbitrarily small (but nonzero) time stretch having t as its origin with an individual that casts a shadow through that time stretch, were all the conditions for an individual to cast a shadow satisfied during that time stretch. On the one hand, this shouldn't be considered counter-intuitive

by anyone who subscribes to the view of objects as mere space-time occupants - what I have been calling the neoQuinean view. It is very much like that view except that it is a bit stronger, in the sense of being more restrictive about when an object exists. The neoQuinean view only states that an object exists iff located in space and time; the shadow reductionist view states that being located is not sufficient, and adds a modal condition: if some object's *de re* modal properties are different from those of a mere shadow caster, then that object does not exist. For example, in the statue-clay case, arguably, neither the statue, nor the clay exists. Take the statue first. It is modally more fragile than the hunk of matter that constitutes it; there are circumstances in which the hunk of matter exists and casts a shadow, while the statue does not exist – one such circumstance is when the statue gets flattened. So the statue never in fact existed. Then take the clay. Arguably, there are circumstances in which the clay does not exist, but the hunk of matter that constitutes it at some other time exists and casts a shadow in those circumstances. For instance, if it is possible that the piece of clay goes out of existence by becoming a piece of matter composed of some other chemical elements than those that compose clay, then in those circumstances the clay does not exist, while the piece of matter that constituted it casts a shadow, from which it follows, according to shadow reductionism, that the piece of clay never existed. Persons also don't exist if by 'person' we mean something that cannot survive biological death. The general idea is this: in all cases of material constitution, i.e. when some object *x* constitutes some object *y*, there is, in fact, only one object, the mere shadow caster, and *x* and/or *y* are identical to that mere shadow caster only insofar as they have the same modal properties as the mere shadow caster.

I am sympathetic to this view, because I am also sympathetic to the neoQuinean view, so to this extent I don't find this view counterintuitive at all. However, there is one detail that could influence one in judging the view. We ended up with an ontological account of objects that makes reference to shadows, that is, to entities that ontologically depend on objects. This might

be a reason for considering the view counterintuitive. But, in fact, reference to shadows is only a way to fix reference to mere hunks of matter. In other words, shadow reductionism is a view according to which an object exists only as a (four-dimensional) hunk of matter – an account of objects proposed and defended by Mark Heller (1990) - where hunks of matter are entities whose persistence conditions are independent of many of their properties, like their shape, or their chemical composition, and dependent on their property of having the power to cast a shadow, if all the conditions for casting a shadow are satisfied.²¹

Instead of a conclusion, I would like to address at this point a worry that the reader might well have: isn't it more commonsensical to just get rid of shadows as such, than to get rid of ordinary objects, or of persistence, or reducing ordinary objects to the status of mere shadow casters? This is a sensible point. However, even if we could smoothly paraphrase sentences committing us to the existence of shadows into sentences free of such commitments (which I doubt), the *Shadow of Constitution Puzzle* remains as much of a puzzle as before. Paraphrases of reference to shadows, like in 'There is a shadow on the wall', would most probably take the form: 'The wall is shaded'. The puzzle remains, because it will still be true, considering our example with the statue and the lump, that at time t_2 the wall is shaded by the statue (because it has continuously been shaded from t_1 to t_2), while there is no statue around to serve as the source of its shading.

NOTES

¹ I will use 'distinct' throughout the paper as standing for 'nonidentical', rather than implying 'nonoverlapping'.

² More exactly, if some things have proper parts, then they are identical iff they have the same proper parts. For a detailed discussion see Peter Simons 1987.

³ Shadows were suggested as counterexamples to Locke's thesis by G. W. v. Leibniz (*New Essays*, II-xxvii-1), Peter van Inwagen (1990: 81), and Roderick Chisholm (1973: 590). Sources cited by Varzi 2000, fn. 12.

⁴ The material body part of what I call a ‘source’ is called a ‘shadow-body’ in Casati 2000.

⁵ ICV is essentially the same as Casati’s and Varzi’s account of shadows as *holes in light*, on the condition of taking holes as immaterially constituted by missing matter. See Casati and Varzi 1994, 1996.

⁶ Thanks to Brendan Jackson for asking me to explain how exactly to understand composition for shadows in the context of making reference to missing light.

⁷ Thanks to an anonymous referee for pointing this out.

⁸ The environment should be favorable to the existence of the shadow. For example it should be free of any intruding light that can destroy the shadow.

⁹ An even stronger entailment could be established, namely, *Same Parts* \Rightarrow *Same Basic Properties*, where basic properties are those whose instantiation does not depend on what happens in the future or in the past; they will comprise both intrinsic and extrinsic properties. See Matthew McGrath (forthcoming).

¹⁰ Thanks to Laurie Paul, David Chalmers, and an anonymous referee for calling my attention to these putative counterexamples.

¹¹ A challenge raised by David Chalmers in discussion.

¹² This kind of ghost object is what we might call ‘Hollywood ghost’, as contrasted with ‘philosophical ghosts’. The former can have causal impact on the concrete material world, while the latter are understood as being able to coincide with any concrete material things, and so have no influence on the material world.

¹³ The challenge was raised by Jacek Brzozowski in discussion.

¹⁴ Though, as pointed out by an anonymous referee, students of physics would not hold such a belief. Given the wave nature of light, there are interference phenomena that generate dark spots, which are described, I think correctly, as shadows.

¹⁵ As pointed out to me by an anonymous referee.

¹⁶ Accounts proposed by those who think that constitution is not identity, but a transitive, irreflexive, and asymmetric relation are, for example, Lynne Rudder Baker 1997, 1999, 2000, Fred Doepke 1982, 1996, E. J. Lowe 1983, 1989, 1996, Peter Simons 1987, Judith Jarvis Thomson 1998, David Wiggins 1968, 1980.

¹⁷ Alan Gibbard 1975, André Gallois 1998, George Myro 1985.

¹⁸ By partial identity I mean distinctness with partial overlap.

¹⁹ However, on Paul’s view the principle of mereological extensionality is still true. So her view is a way of squaring the idea of nonidentity between spatiotemporally coinciding objects with the truth of extensionality.

²⁰ Van Inwagen (1990) is not to be included in this category, as his *organicism* view denies (i) for all substitution instances of *F* except when *F* is a simple or a living organism, and (ii) for all substitution instances of *F* except when *F* is a living organism.

²¹ Part of those conditions is that there be no obtruder of light, so completely transparent objects are not ruled out: they have the power to cast a shadow, conditional, for instance, on their being covered with black dye. Also, the fact that a hunk of matter can be pulverized at some time after *t* does not count against its existence; it is part of the conditions for casting a shadow through the relevant time stretch that the hunk of matter not be pulverized.

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