Philos Stud (2009) 145:35–67
DOI 10.1007/s11098-009-9390-x

Individuals: an essay in revisionary metaphysics

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Published online: 24 April 2009

Abstract We naturally think of the material world as being populated by a large number of *individuals*. These are things, such as my laptop and the particles that compose it, that we describe as being propertied and related in various ways when we describe the material world around us. In this paper I argue that, fundamentally speaking at least, there are no such things as material individuals. I then propose and defend an individual-less view of the material world I call "generalism".

Keywords Bundle theory · Generalism · Holism · Individuals · Velocity

We naturally think of the material world as being populated by a large number of *individuals*. These are things, such as my laptop and the particles that compose it, that we describe as being propertied and related in various ways when we describe the material world around us.

To what extent is this natural conception true of the fundamental structure of reality? In this paper I propose a view on which it gets things entirely wrong. Fundamentally speaking, I claim, there are no such things as individuals. As we will see, my view has the surprising consequence that the world is, in a well-defined sense to be discussed later, radically *holistic*: that it is at root a unified whole rather than a collection of disparate parts. The view is best motivated, I believe, by facts about the structure of our best-confirmed laws of physics—facts that have been well known to philosophers for quite some time, but for one reason or another have so far been overlooked.

I proceed as follows. In Sect. 1, I argue against the view that the fundamental furniture of the material world includes a domain of individuals, a view I call

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individualism. On this view the most basic, irreducible facts about our world include facts about what individuals there are and how they are propertied and related to one another, such as

a is F, *b* is G, *a* bears R to *b*

where *a* and *b* are individuals, or "primitive individuals" as I will call them to underline their status on this view.[1] My argument against individualism is based on what I show to be a striking analogy between primitive individuals and absolute velocity, by which I mean the velocity of a material body through absolute space rather than relative to another material body. Roughly speaking, the analogy is that our best physical theories imply that both are *physically redundant* and *empirically undetectable*. Contemporary orthodoxy counts this as reason enough to doubt that absolute velocity is real, and I will argue that consistency demands we adopt the same attitude about primitive individuals.

If we reject individualism, what are we to replace it with? One view, the famous *bundle theory*, says that individuals are not primitive entities but are instead nothing other than bundles of properties. But in Sect. 2 I argue that the bundle theory is inadequate as a response to my arguments against individualism. If we reject individualism for the reasons outlined in Sect. 1, we should not adopt the bundle theory in response.

In Sect. 3 I propose my own view about the structure of the material world, a view I call *generalism*. While the bundle theorist constructs *individuals* out of properties, the generalist bypasses individuals and simply constructs *facts* out of properties instead. To my knowledge, generalism has not been discussed in the recent literature, but I argue that it is perfectly suited as a response to the arguments against primitive individuals. Insofar as the considerations in Sect. 1 give us good reason to reject individualism, then, they give us good reason to adopt generalism instead.

But *good* reasons to adopt generalism need not be *decisive* reasons: whether we should ultimately adopt it depends on its overall theoretical virtues. And as we will see, generalism departs radically from our pre-theoretic conception of the world in a number of ways, so this may be seen as a point against it. But in Sect. 4 I argue that generalism has just the theoretical virtues we normally demand of a view that revises pre-theoretic belief, such as explanatory adequacy, simplicity and, importantly, the resources to explain away our pre-theoretic convictions on its own terms. All things considered, then, I conclude in favor of generalism.

Before we begin I should say that my methods may seem foreign to readers familiar with the literature on individuals, which tends to focus on purely apriori, modal considerations. For example, individualists have famously argued on apriori

[1] Individualism is perhaps the most natural view about the structure of our world and is implicit in a large amount of contemporary philosophy. Any metaphysician who describes the fundamental structure of the world by describing what individuals there are and what they are like is, at least implicitly, an individualist. For example, see Lewis (1986). More explicit endorsements of individualism can be found in Wittgenstein (1933) and Russell (1985); and, more recently, in Allaire (1963), Armstrong (1997), and Hawthorne and Sider (2002). Note that the individualist need not claim that *all* individuals are fundamental entities: she may think, for example, that chairs and tables are nothing other than collections of electrons and quarks.

grounds that there is a possible world containing just two indistinguishable spheres, and they argue that the bundle theorist cannot make sense of such a world since their view implies that indistinguishable things are identical.[2] In this paper I diverge from the literature by bracketing these sorts of issues and asking instead what we can learn from physics. Surprisingly, this question has been largely ignored in the literature. Whether apriori modal considerations have anything to add is a question I leave for another time.

I should also add that my topic in this paper is restricted to the structure of the *material* world. When I ask whether there are any such things as primitive individuals, this is shorthand for asking whether the material world contains any such things. The structure of the non-material world—if there is anything answering to that description—is a topic for another occassion.

1 Against individualism

As I said, I think we should reject primitive individuals for the same reason that contemporary orthodoxy rejects absolute velocity: our best physical theories imply that they are physically redundant and empirically undetectable. But, as we will see, this charge is easily misunderstood in the case of individuals. So I propose to start by clarifying exactly what the charge amounts to in the case of velocity. After that I will argue that the same charge can be leveled against primitive individuals. Finally, I will say why their redundancy and undetectability give us reason to doubt their reality.

1.1 A primer on velocity

Consider a car cruising down the highway alongside a train. It is traveling at 55 mph *relative to the highway* and 10 mph *relative to the train*. But how fast it is *really* traveling, independent of any reference point? One popular response to this question is that there is no answer: there is no such thing as its absolute velocity, only its velocity relative to other reference points, none of which is privileged over the others as defining its *real* velocity.[3]

What motivates this response? These days it is not thought to be an apriori issue; rather, the idea is that we can learn from physics. An example will help. Consider Newtonian Gravitation Theory (NGT), by which I mean Newton's three laws of motion and his inverse-square gravitational force law. The orthodox view these days is that if we had reason to think that the laws of NGT were the true and complete physical laws of motion, that would give us reason to think that absolute velocity is not real.[4] But why?

[2] The classic paper is Black (1954). For more contemporary literature in this vein see O'Leary-Hawthorne (1995), Zimmerman (1998), and references therein.

[3] Readers familiar with the substantivalism/relationalism debate should note that I allow "reference points" to include unoccupied inertial trajectories in substantival space-time.

[4] I am slurring over a subtlety here. The laws of NGT *as written down by Newton himself* make reference to absolute velocity, so what Newton wrote down would not be true if there were no such thing as

The answer is that if the laws of NGT were the true and complete laws of motion, then if absolute velocity were real it would be *physically redundant* and *empirically undetectable*. Admittedly, some theorists emphasize the redundancy and others the undetectability, so there may be some disagreement over which of these is most important.[5] But no matter: everyone agrees that NGT implies both the redundancy and undetectability of absolute velocity, and that one or both implications give us reason to doubt its reality. Later, I will argue that *every* physical theory seriously considered over the past 400 years has *both* implications about primitive individuals. But first let me explain what the implications consist in.

To start, what does it mean to say that absolute velocity is empirically undetectable? The concept is best illustrated by outlining a particular line of argument and asking what the argument shows. We are all familiar with the fact that sitting in an airplane in smooth motion feels just like sitting in one at rest on the runway, and this naturally motivates the idea that we cannot tell smooth motion from rest. But in fact this thought experiment is not conclusive, for it leaves open the possibility that we could build a *measuring device* to help us detect our absolute velocity. After all, we cannot detect a particle's charge with the naked eye either; we need to build complex electrometers which detect charge for us and display it on a screen. So the question arises whether it is possible to build an "absolute velocity measuring device". Surprisingly, the literature contains little explicit discussion of this question. But in fact there is a line of argument which shows that if the laws of NGT were the true and complete physical laws, there could be no such device. It will prove useful to rehearse the argument before applying it to the case of primitive individuals.[6]

Imagine trying to build a device that detects whether it is moving or at rest. What properties must this device have? At a minimum, it would need to be sensitive to whether it is moving or not. But it is worth being quite specific about what this means. Presumably, it would need to have a "ready state" in which it is set up to measure its velocity through space. And it would need to be built in such a way that if it were in its ready state at some initial time t_0 and was then switched on *while moving*, it would whir away and then register this fact by, say, displaying 'Moving' on a computer screen at some later time t_1. Correspondingly, if it were in its ready state at t_0 and then switched on *while at rest*, it would then register this differently, say by displaying 'At rest' on the screen at t_1 instead.

Footnote 4 continued
absolute velocity. But I am using the phrase 'laws of NGT' to refer to laws that can be expressed in different ways depending on what one takes to be the underlying metaphysics of the world they govern. We use 'the Schrodinger equation' in quantum mechanics the same way, to refer to a law that will be formulated in very different ways depending on one's view about the fundamental ontology of a quantum mechanical world. The claim in the text, then, is that orthodoxy considers a theory that dispenses with absolute velocity and formulates Newton's laws without reference to it better than Newton's own theory.

[5] Earman (1989, p. 44), emphasizes the redundancy; Maudlin (1993, p. 192), emphasizes the undetectability; while van Fraassen and Ismael (2003) appear to emphasize both.

[6] This line of argument is very rarely discussed explicitly in the philosophical literature, though see Roberts (2008) for an exception. Feynman gestures at it in his (1963, Chap. 16). I have also heard versions of it in seminars given by David Albert and Tim Maudlin.

But it is straightforward to show that if the laws of NGT were the true and complete physical laws, it would be impossible to build a device with these properties no matter how much funding were made available. The key fact about NGT is this:

> Given any two closed systems governed by (and only by) the laws of NGT, if at an initial time they differ only in facts about absolute velocity but are exactly the same in all other respects, including all facts about relative velocity, then they will continue to be exactly the same in all those other respects at all subsequent times.[7]

This implies that any two closed systems like this will continue to agree at all subsequent times on all facts about the relative positions of things, including the pattern of pixels illuminated on computer screens. So, let us suppose that an "absolute velocity measuring device" in its ready state is switched on while at rest at t_0, and at t_1 the word 'At Rest' is displayed on its screen. Then no matter how the device was built, no matter how many years of technological development was invested in it, it follows immediately from the indented claim above that if the entire system had differed at t_0 only in its absolute velocity, the device would still have displayed 'At Rest' at t_1. So the device does not have the properties specified in the last paragraph.

Notice how powerful this form of argument is: analogous reasoning establishes that no device can display our absolute velocity in pointer positions, or patterns of ink on computer printouts, or sounds emanating from speakers, or…. And it is hard to see how else a device could display our velocity, if not in these sorts of media. So the argument establishes, purely on the basis of the structure of the laws of NGT, that *if they were the true and complete laws governing our world we would be precluded from ever being able to distinguish between closed systems that initially differ only in facts about their absolute velocities*. This is what I mean when I say that absolute velocity is empirically undetectable according to NGT.[8]

Of course, one can imagine other laws according to which initial differences in absolute velocity would lead to subsequent differences in inter-particle differences, and if those were the true and complete laws of motion we could perhaps build an "absolute velocity measuring device" that exploited this fact. But the laws of NGT

[7] This slurs over some subtleties. First, the term 'closed systems' is used as a dummy-term. The reader can think of closed systems as possible worlds, or as mathematical models, or as idealized laboratories with walls that "insulate" against effects from outside. Second, I leave open whether the "initial time" refers to an *instant* or a (perhaps infintesimally small) *period* of time. Incidentally, some theorists describe the indented claim as the fact that NGT is "symmetric under uniform velocity boosts" (see for example Wigner 1967). More contemporary formulations of 'symmetry' are somewhat different and avoid the complications just mentioned, but the formulation in the text is more intuitive and will suffice for our purposes here.

[8] I believe that this form of argument has been extremely influential throughout the history of physics. For example, when formulating his Special Theory of Relativity, I would argue that Einstein was guided (in part) by the constraint that the correct laws of physics must imply, through reasoning much like that rehearsed, that absolute velocity is empirically undetectable. Admittedly, there is much more to say about what empirical undetectability really amounts to, but a full discussion of the issues involved would take us too far from the main thread of the current paper so I will use the rough characterization in the text for simplicity. I say more about what empirical detectability amounts to in my *Symmetry and the Undetectable*, in preparation.

are not like this, and that is why they imply that absolute velocity is empirically undetectable. Later, I will show that precisely the same sort of argument can be used to show that *every* physical theory we have taken seriously over the past 400 years implies that primitive individuals are empirically undetectable too.

But first we need to finish our primer on velocity. I have just explained why absolute velocity is *empirically undetectable* according to NGT, but the other charge is that it is *physically redundant* according to NGT. What does this mean? It means nothing other than the indented claim above. For the intuitive idea behind that claim is that according to NGT, "mere" differences in absolute velocity do not give rise to any other differences at later times. Note that this is in stark contrast to other quantities: an initial difference in facts about *mass* would give rise (via F = MA) to differences in acceleration and therefore to differences in inter-particle distances at subsequent times, and this is precisely what devices that measure mass exploit. But differences in absolute velocity have no such effect, and as we just saw this fact can be used to argue that velocity is empirically undetectable.

1.2 Primitive individuals as danglers

As a shorthand, call something a *dangler* if and only if it is physically redundant and empirically undetectable. I just argued that it is a consequence of NGT that absolute velocity is a dangler. I will now argue that

(1) It is a consequence of every physical theory considered over the past 400 years that primitive individuals are danglers.

This is the first premise of my argument against individualism and in favor of my alternative metaphysics. Now, redundancy is relatively straightforward. Call facts that concern particular primitive individuals, such as

a is F, b is G, a bears R to b, $a \neq b$

individualistic facts. And call facts that do not concern any particular primitive individual *general facts*. These include facts that can be expressed in predicate logic without constants (but with identity), such as

$(\exists x)Fx, (\exists y)Gy, (\exists x)(\exists y)Rxy, (\exists x)(\exists y)x \neq y$

(I assume that the predicates just used do not include substitutes for constants, such as '*x* Socratizes'.) These facts may be taken to imply the existence of individuals, but they are not individualistic facts because they do not concern any particular primitive individual. The claim that primitive individuals are redundant to NGT can now be stated as follows:

> Given any two closed systems governed by (and only by) the laws of NGT, if at an initial time they differ only in their individualistic facts but are exactly the same in all other respects, including all general facts, then they will continue to be exactly the same in all those other respects at all subsequent times.

For example, consider the following system: a primitive individual called Peter is at an initial time t_0 propelled up in the air by a slingshot, only to fall by gravity back to Earth. And now consider a different system whose initial state at t_0 differs only in the fact that a different primitive individual, Paul, is slung. By hypothesis, we are to suppose that Peter and Paul have the same mass, shape, charge and so on. What the indented claim implies is that if the two systems both obey NGT, then Paul will make exactly the same trajectory through space as Peter. According to NGT, the identity of each particle makes no difference to how the slingshot or the Earth's gravitational field affect it.

So, just as with absolute velocity, it is a straightforward consequence of NGT that mere differences in individualistic facts at an initial time do not give rise to differences in the future evolution of inter-particle distances or any other difference; in particular, they do they give rise to any difference in general facts. We can imagine other laws in which the identities of the primitive individuals that initially compose a system has an effect on the future evolution of inter-particle distances.[9] But the laws of NGT are not like that, and it is uncontroversial that none of the physical theories we have considered over the past 400 years are like that either. So primitive individuals are redundant to all our best physical theories in the same sense as absolute velocity is redundant to NGT.[10]

Of course, one might hold that the existence of primitive individuals is entailed by (non-trivial) general facts, and therefore that they are not redundant in some other sense. I will discuss this when I discuss how best to dispense with primitive individuals in Sect. 3. My claim here is just that primitive individuals are redundant *in the sense defined above*, namely that mere differences in individualistic facts do not give rise to any other differences at later times.

To establish (1), we also need to argue that primitive individuals are empirically undetectable according to our best physics. It is worth noting here that there is a distinguished tradition according to which we do indeed lack a certain kind of epistemic access to primitive individuals. Russell, to take just one example, described them as 'an unknowable something' and said that they 'cannot be defined or recognized or known'.[11] Part of the intuition is that since they are "clothed" in properties one can only ever see the properties and never the individual itself, much as I cannot see someone's skin when they wear an anorak. But this is only metaphorical, and many contemporary philosophers think that Russell was misguided.[12] I think Russell was onto something, but I believe a better way of

[9] Earman (2002, pp. 6–7) discusses the possibility of laws of this type. Aristotle's physics might be thought of as a theory of this sort: he thought that the universe had a distinguished center, with earth gravitating towards it and fire away from it.

[10] This statement of redundancy assumes that the laws are deterministic. The generalization to probabilistic laws is reasonably straightforward, but considerations of space prevent me from discussing it here.

[11] Russell (1948a, 1948b, p. 97) respectively. Other proponents of this tradition include Locke, who described primitive individuals as an 'unknown support of those qualities' (see Locke 1997, II xxiii 2); and Hume, who described them as 'unknown and invisible' (see Hume 1978, p. 220). I should say that none of these authors called their subject matter "primitive individuals", but I believe they were all talking about them.

[12] See for example Armstrong (1997, pp. 95–96) and Sider (2006, p. 289).

making the point is to say that primitive individuals are empirically undetectable. As we will see, putting things this way avoids potential objections to Russell's way of putting things.

To argue that primitive individuals are empirically undetectable, let us use the case of absolute velocity as a guide. In that case, we started out by noticing that an airplane in smooth motion would look and feel and smell exactly the same if it were at rest on the runway, and this motivated the idea that we cannot tell smooth motion from rest. What is the analogous thought in the case of individuals? Well, imagine a situation in which there is a primitive individual is placed in front of you. Depending on what sorts of things primitive individuals are (or would be, if they were real!), this might be a situation in which you are in front of a chair, or an electron, or perhaps something else. To fix ideas, let us suppose without loss of generality that it is a chair. And now imagine a situation in which everything is exactly the same except that a different primitive individual is in front of you. Suppose this different individual has exactly the same qualities as the actual chair in front of you: imagine it were colored the same, shaped the same, and so on. The analogous thought to that in the case of velocity is that the situation would look and feel and smell exactly the same to you: we cannot tell the difference between situations that differ only in their individualistic facts.[13]

Now, as in the case of velocity, this sort of thought experiment is not conclusive because it leaves open that we could *build a device* that would allow us to distinguish between the two situations. But I claim that the redundancy of primitive individuals in all our best-confirmed physical theories means that *if the laws of physics are anything like what we think they are, it is impossible to build such a device no matter how much funding we are granted*. If this is right, then primitive individuals are empirically undetectable according to our best-confirmed physics in precisely the same sense as absolute velocity is empirically undetectable according to NGT.

The argument is just like the one we ran in the case of absolute velocity. Consider a particular primitive individual α, and imagine what property an α-detector must have. Presumably, it would need to have a "ready state" in which it is set up to detect whether it is in front of α. And it would need to be built in such a way that if it were in its ready state at some initial time t_0 and were switched on in front of α, it would register that fact by (say) making a dial swing to the *right* at some later time t_1; while if it were switched on in front of something else the dial would swing to the *left* at t_1 instead. But it follows immediately from the redundancy of primitive individuals in all our best-confirmed physical theories that this machine is impossible if anything like those theories is true. For let us suppose that an "α-detector" in its ready state is switched on in front of α at time t_0, and at t_1 the dial swings to the right. Then *no matter how the device was built, no matter how many*

[13] Not all philosophers would agree with the way I put things here. For example, Campbell (2002) defends a view on which the phenomenal character of an experience depends on which individual one is presented with, and he may therefore want to say that the two situations would look different. Nonetheless, he can agree that there is a sense in which the two situations are indistinguishable and that we cannot tell the difference between them. This is, strictly speaking, all my arguments require, but for ease of prose I shall sometimes slur over this subtlety and talk of the situations as looking the same.

years of technological development was invested in it, the redundancy of primitive individuals in the laws of physics implies that if the entire system had differed at t_0 only with respect to what primitive individual was in front of the device, the dial would still have swung to the right. So the device does not have the property specified earlier in this paragraph.

So I claim that primitive individuals have the same status in contemporary physics as absolute velocity has in NGT: they are physically redundant and empirically undetectable. This outlines my argument in favor of the claim that:

(1) It is a consequence of every physical theory we have considered over the past 400 years that primitive individuals are danglers.

Now, contemporary orthodoxy thinks that if absolute velocity were a dangler, this would be a good reason to doubt its reality. Out of consistency, then, I claim that we should take ourselves to have good reason to doubt the reality of primitive individuals.

1.3 Dispensing with danglers

But I have not yet said anything about *why* something's being a dangler should give us reason to doubt its reality, so let me turn to this question now. Then I will discuss potential objections to my line of argument.

If we discover that something is a dangler, I do not claim that this is a *decisive* reason to think that it is unreal. But I do think it is *something* of a vice if a theory about the structure of the world implies that there are danglers. Specifically:

(2) Consider two theories about the structure of the material world, and suppose you discover that the first implies that the world contains a dangler while the other does not. All else being equal, it is rational for you to prefer the latter over the former.

In Sect. 3 I will introduce generalism, a theory about the structure of the world that dispenses with primitive individuals. And in Sect. 4 I will argue that "all else is equal", i.e. that it scores equally well on other theoretical virtues such as simplicity, explanatory adequacy, and so on. That will constitute my argument against individualism and in favor of generalism.

It is worth noting that (2) is assumed, perhaps implicitly, throughout the philosophy and physics literature. The case of absolute velocity in NGT is one example, but the case of absolute simultaneity in the Special Theory of Relativity (STR) is perhaps more striking. It is often remarked that according to the laws of STR there are no facts about absolute simultaneity—i.e. facts about whether two events occur at the same time—only facts about simultaneity relative to an inertial frame of reference. But this remark is not strictly speaking true: on the Lorenz formulation, the laws of STR govern the motions of particles through a classical space-time structure in which there are well-defined facts about absolute simultaneity. What *is* true, though, is that absolute simultaneity is a dangler in STR. The incorrect remark is so often made, I think, because (2) is so widely taken for granted.

The justification for (2) is broadly speaking Occamist, and is nicely illustrated with the case of absolute velocity. Suppose the laws of NGT are the true and complete laws of our world, and therefore absolute velocity is a dangler. The redundancy of absolute velocity means that initial differences in absolute velocity do not give rise to any other difference such as a difference in inter-particle distances. So there is a sense in which the particular absolute velocity of a system at an initial time is not needed to explain any facts about subsequent inter-particle distances and so on: even if its initial absolute velocity had been different, all facts about inter-particle distances would have been the same. Does this mean that facts about the particular absolute velocity of a system are never needed in explanations? Not quite, because it remains the case that the initial absolute velocity of a system is required to explain its absolute velocity at later times. But this is where the undetectability comes in: for if facts about absolute velocities are empirically undetectable, then facts about the particular absolute velocity of a system at an initial time are not required to explain *anything we can empirically detect*! Therefore, Occam's razor has us prefer theories about the structure of the material world that dispense with them (all else being equal). Precisely the same goes for primitive individuals: the redundancy and undetectability of individualistic facts implies that they are not required to explain anything we can empirically detect.

This, in broad outline, is the theoretical motivation behind (2). In addition, I would also add that the project of attempting to dispense with danglers has borne much theoretical fruit in the past (for example, in the theory of motion). So I think there is a pragmatic reason for continuing the project in the case of primitive individuals, if only to see where it leads.

It is worth guarding against some potential misunderstandings. First, (2) only concerns theories about the structure of the material world, so it does not say anything about whether we should believe in immaterial souls or abstracta such as numbers, sets and so on. Second, (2) is not a rabid "get rid of everything that is not physics" principle sometimes found implicit in the literature. The property of being a table, for example, is a high-level property not referred to in physics text-books; but this property is neither empirically undetectable nor physically redundant in the senses specified earlier. Therefore, (2) does not recommend dispensing with this property. Third, (2) does not say that it is meaningless to talk about danglers, or that it is part of the meaning of 'reality' that empirically undetectable structure is not real. So it is not a verificationist principle, and is perfectly consistent with the claim that some danglers are real. It just says that we have reason to dispense with danglers, all else being equal.

1.4 Two objections

So far I have motivated (1) and (2). If they are right, we should be interested in whether there is a theory about the structure of the material world that dispenses with primitive individuals, since (all else being equal) it would be rational for us to prefer it. But before I propose a theory of that sort, let me pause to consider two objections to my line of argument so far.

The first objection claims that experience presents us with a world full of individuals. We may agree with (1) that we are unable to empirically detect which particular ones they are; but, the objection goes, our experiences nonetheless present them as being there. The objection is that a theory that dispenses with primitive individuals cannot account for this datum and so should not be accepted; therefore, (2) is false.

In reply, I can agree for the sake of argument that experience presents us with a world full of individuals, for this is no objection to (2). Remember, (2) just says that *all else being equal*, we are rational to prefer theories without danglers. If a theory that dispenses with primitive individuals cannot account for how the world appears, then all else would not be equal. At best, this objection points out is that there is an onus on me to show that the alternative metaphysics I propose can account for how the world appears. Once we have the view on the table, I will argue that it can.

A second objection is that (1) is false. (1) implies that when faced with a primitive individual in front of you, say a chair, you cannot empirically detect which primitive individual it is. Against this, it may be pointed out that it is perfectly possible to know which chair it is. I think this sort of point convinced people that Russell was wrong when he said that primitive individuals were an 'unknowable something'.

Now as stated, the objection simply confuses the question of whether we can *empirically detect which primitive individual it is*, with the question of whether we can *know what chair it is*. To respond, I will argue that (i) even if we grant the objector that we can know what chair it is, it does not follow that we can empirically detect which primitive individual it is; and (ii) it is empirical detection, not "knowing what", that matters to the Occamist argument outlined above.

There are two things the objector may mean by "knowing what". First, suppose I ask whether you know what chair is in front of you. A natural response would be 'Sure, I know that it is the only chair I own', or 'Sure, I know that it is the one I sat on yesterday.' The thought here is that if you know that the chair uniquely has as a certain property (as in the first answer), or if you are able to re-identify the chair over time (as in the second answer), then you know what chair is in front of you.[14]

This may be right, at least in the colloquial sense of "knowing what". But still, it does not follow that you can empirically detect what individual is in front of you. For even if you know that the chair in front of you uniquely has a given property and is the same chair you sat in yesterday, the individualist claims that there is a *further fact of the matter* concerning its identity. And what we argued earlier is that situations that differ only in this further fact—e.g. in which a different primitive individual is in front of you and was the chair you sat in yesterday—are indistinguishable if the laws of motion governing our world are anything like we think they are. Therefore, even if you know what chair is in front of you in this colloquial sense, it does not follow that you can empirically detect what primitive individual it is.

[14] See Strawson (1959, pp. 15–38) for a discussion of the importance of these everyday senses of 'knowing what'.

In fact, precisely the same can be said in the case of absolute velocity. Suppose I ask whether you know what your velocity is. In some contexts, it may be appropriate to answer 'Sure, I know that my velocity is the same as it was yesterday'. But this does not mean you can empirically detect absolute velocity. For even if you know that your velocity has not changed since yesterday, the believer in absolute velocity thinks there is a *further fact of the matter* concerning what your absolute velocity is. And we argued earlier that according to NGT, situations that differ only in this further fact are indistinguishable; therefore, it remains the case that absolute velocity is empirically undetectable according to NGT.

Now the objector may point out that it is easy to acquire knowledge of this further fact of the matter concerning the identity of the individual in front of you: simply point at the chair and think *the individual in front of me is* ***that*** *one*! The idea would be that the content of your belief so formed would depend on the identity of the primitive individual in front of you. As a result, if you had formed a belief like this in a situation that differed only with respect to the identity of the individual, you would have formed a different belief that is true of that other individual instead. Some theorists may therefore count this as knowing the further fact of the matter concerning the individual's identity. This is the second notion of "knowing what chair it is" that the objector may have had in mind.

In response, I grant that this sort of knowledge of primitive individuals is possible—or at least would be, if there were such things! But it would not count as empirically detecting what individual is in front of you. For it would remain the case that two scenarios differing only in their individualistic facts are indistinguishable, and therefore primitive individuals would still be empirically undetectable in our sense. This is not to deny that there is an important category of belief of the sort just discussed, often called "de re" belief in the literature. And if I take this category seriously, there is an onus on me to show how my alternative view can account for it if, as the view claims, there is at a fundamental level no "re". Once my view is on the table I will argue that it can. For now, my point is just that the possibility of this sort of belief does not affect the truth of (1).[15]

So in neither sense of "knowing what" does *knowing what chair it is* imply having *empirically detected what primitive individual it is*. And I claim that it is empirical detection, not "knowing what" (in either sense), that matters to the Occamist argument against primitive individuals. For when a feature of the material world is empirically undetectable, it is impossible (given the laws) to distinguish between situations that differ with respect to facts about that feature. The Occamist razor I wish to wield simply says that we have reason to dispense with the putative structure that differentiates between those situations. The fact that if individuals

[15] One might argue that the same remarks apply to the case of velocity. Suppose you said to yourself 'I hereby let "Bob" name the real number that is my absolute velocity in miles per hour', and then thought *my velocity through space is Bob miles per hour*. Now, it is debatable whether this would really result in a similar type of knowledge as that just outlined in the case of individuals. But even if we grant that it would, it remains the case that scenarios differing only in facts about absolute velocity would be indistinguishable to you, and so it would remain the case that absolute velocity is empirically undetectable in our sense.

were real we could re-identify them over time or have de re beliefs about them is, according to this Occamist razor, neither here nor there.

There is much more to say about the line of argument I have been pursuing.[16] But I take the analogy with absolute velocity to suggest that there is something to it. If so, we should be interested in whether there is a defendable theory of the material world that dispenses with primitive individuals.

2 Against the bundle theory

But if individuals are not primitive entities, what are they? A natural suggestion is that they are nothing other than bundles of properties. This is the well-known "bundle theory" of individuals.

Now, the bundle theorist does not think that any old collection of universals bundles an individual. Instead, she says that properties bundle an individual when and only when the properties are "compresent". What does this mean? The bundle theorist is likely to take 'compresence' as a primitive predicate. Intuitively, when the bundle theorist says that the properties F and G are compresent, she means to describe a situation that the individualist would describe by saying that F and G are instantiated by the same individual. So, when the individualist says that my laptop is black and solid, the bundle theorist says instead that *blackness* and *solidness* are compresent. Finally, if individuals are to be identified with *bundles of* universals, there must be a bundling operation that takes compresent universals and delivers another entity, the individual.[17]

Such is the standard presentation of the bundle theory. One would expect the bundle theorist to further clarify her view by supplying a logic for the compresence predicate and the bundling operation. But unfortunately the theory is rarely developed in detail, and as a result many questions are left open. Can relations be compressed with other properties? What is the adicity of the compresence relation? Are the compresence relation and the bundling operation one and the same? We are not told, and the view could in principle be developed in many directions.[18]

Fortunately, nothing I say here will depend on these details, but only on two uncontroversial facts about the view. First, when our bundle theorist says that individuals are bundles of properties, she means something rather specific by 'property'. For since she wishes to dispense with primitive individuals, she cannot think that properties are themselves sets of primitive individuals. Nor can she think they are tropes or property-instances such as *this very redness* of my sweater, where this is a different entity than *that very redness* of my apple even if my sweater and my apple are exactly the same color. For one can argue that these are danglers just like primitive individuals: I cannot empirically detect whether my sweater has *this*

[16] I try to say some of it in Dasgupta, *Symmetry and the Undetectable*, in preparation.

[17] The bundle theory can be traced back to many historical philosophers including Russell (1948a, 1948b). Its contemporary advocates include Paul (2002), and Cover and O'Leary-Hawthorne (1998).

[18] Hawthorne and Sider (2002) develop the view in more detail than most; however, the view they emerge with (though do not endorse) has more in common with the theory I develop in the next section.

very redness or *another redness* of exactly the same color. Instead, by 'property' our bundle theorist will mean a *universal*: a quality that individualists would describe as being capable of instantiation by many things at once. On this conception of a property, the redness of my sweater is one and the same thing as the redness of my apple.

The second fact about the bundle theory is that it implies a principle known as the Identity of Indiscernibles (IOI), which states that it is not possible for two individuals to share the very same universals.[19] It implies this because the driving idea behind the view is that there is nothing more to an individual than the universals that bundle it; if the same universals could give rise to different individuals, this idea would be lost.[20]

Unfortunately, this commitment to IOI means that the bundle theory is unsatisfactory as a response to the problem of danglers. For consider a world that we would ordinarily describe as containing exactly two individuals both of which have the very same universals; specifically, suppose that they each have the universal F and nothing else. Since she endorses IOI, the bundle theorist rules this world as impossible. But notice that the putative world can be characterized in purely general terms by the following sentence:

$$(\mathrm{A}) \quad (\exists x)(\exists y)(Fx \,\&\, Fy \,\&\, x \neq y)$$

Therefore, by ruling this world as impossible, the bundle theorist puts a restriction on the sorts of general facts that can hold.

To see why this is a problem, consider again the case of velocity. What is the standard response to the discovery that absolute velocity is a dangler in NGT? It is to adopt the view that Newton's laws are better formulated on a "Galilean" space-time structure instead. What is a Galilean space-time structure? The details need not concern us here, but two things are important. First, in a Galilean structure there is no such thing as a particle's absolute velocity, only its velocity relative to inertial frames of reference. And, second, a Galilean structure *places no restriction on the pattern of relative velocities that a system of particles may display*.

This second point is crucial. If the arguments outlined in the last section were successful they established that absolute velocity is physically redundant and empirically undetectable in NGT, but they did not establish anything about relative velocity. Even if those arguments worked, for example, it remains open that relative velocity is empirically detectable according to NGT. So if one wants to dispense with absolute velocity *because it is a dangler*, it would be somewhat perverse to adopt a view that dispenses with it and, in addition, constrains the pattern of relative velocities that a system of bodies may instantiate. For example, suppose the new

[19] I should say that the title 'Identity of Indiscernibles' is sometimes used to name other related principles, but the details of these other principles need not concern us here.

[20] It is uncontroversial that the bundle theory implies IOI. What is controversial is whether this counts against the view. See Hacking (1975) and O'Leary-Hawthorne (1995) for arguments that it does not. I should say that some theorists appear to deny that the bundle theory implies IOI (for example, Rodriguez-Pereyra 2004), but on closer examination it invariably turns out that they are referring to views that identify individuals with bundles of property-instances or tropes. For the reasons just given in the text, this is not the sort of view under consideration here.

view implied that a world in which there are just two particles at rest relative to one another is impossible. Then we would be entitled to complain that we only wished to dispense with absolute velocities; we did not in addition want to rule out certain patterns of relative velocities as impossible.

Returning to the case of individuals, the analogous arguments purported to establish that individualistic facts are physically redundant and empirically undetectable, but they did not establish anything about general facts. Even if the arguments were successful, for example, it remains open that general facts are empirically detectable. So if our aim is to dispense with primitive individuals *because they are danglers*, it would be somewhat perverse if our replacement view put additional constraints on what sorts of general facts can hold. But this is exactly what the bundle theory does! So the bundle theory is unsatisfactory as a response to the problem of danglers in just the same way as the strange theory of motion mentioned at the end of the last paragraph. This is by no means a conclusive objection to the bundle theory, but it does show that it is at best an inelegant response to the problem of danglers. A more elegant response would dispense with primitive individuals without constraining the sorts of general facts that can hold. Let us see if we can develop a view of that sort.[21]

3 Generalism

The bundle theorist went astray because she asked 'What are individuals, if not primitive entities?' The natural answer was that they are nothing other than bundles of properties, and she was thereby led to a view that implies IOI and which therefore constrains what sorts of general facts are possible.

I propose that we adopt a different strategy. Unlike the bundle theorist, we will not ask how to construct individuals out of more basic entities. Instead, we will simply ask for an account of the fundamental structure of the world that dispenses with primitive individuals but which allows us to make sense of the whole array of possible general facts, including that expressed by (A), and which therefore does not imply IOI. This approach mirrors our approach in the case of velocity, in which we develop a metaphysics of motion that dispenses with absolute velocity but places no restriction on the pattern of relative velocities that a system can display.[22]

How might we develop such a metaphysics? To clear the ground, let me briefly put aside two ideas. One idea is to propose that individualistic facts *supervene on* general facts: if two possible worlds agree on all their general facts they agree on all

[21] Just to clarify, my objection to the bundle theory is not that it implies IOI *and we have apriori reasons to think that there are possible worlds that are counterexamples to IOI*. Others object to the bundle theory in this way, but as I said in the introduction I wish to bracket apriori intuitions about what worlds are possible. Instead, my objection is that the bundle theory implies IOI *and IOI is utterly unmotivated by my arguments against primitive individuals*.

[22] It may be interesting to note that in his seminal paper on this topic, Adams (1979) claims that the denial of primitive individuals 'stands or falls… with a certain doctrine of the Identity of Indiscernibles' (p. 11). I believe he said this because he fell into the same trap as the bundle theorist, namely of asking what individuals are, if not primitive entities. I hope to show here that another approach is possible.

their individualistic facts. The idea is that on this view, individualistic facts are determined by the general facts, at least on a modal sense of 'determined'.[23]

To see why this suggestion will not do, consider the analogue view in the case of velocity. The analogue view is that facts about absolute velocity supervene on facts about relative velocity: if two possible worlds agree on all facts about relative velocities they agree on all facts about absolute velocity. Now this view is perfectly consistent with the view that absolute velocity is a real quantity in terms of which relative velocity is defined; all it says is that there is a (rather bizarre) modal connection between the two quantities. So in and of itself, this modal claim does nothing to dispense with absolute velocity. To dispense with absolute velocity, we instead need to adopt a theory about the *structure of the actual world*, namely a Galilean space-time structure. This may *imply* certain modal claims, such as that all facts about motion supervene on facts about relative velocities, but it is not at root a modal claim.

Similarly in the case of individuals. All the current suggestion says is that there is a certain modal connection between general and individualistic facts. But this modal claim is one that the individualist is free to agree with, so in and of itself it does nothing to dispense with primitive individuals. Instead, we want a theory about the *structure of the actual world* that dispenses with primitive individuals. This new theory may *imply* certain modal claims, such as that all facts supervene on general facts, but at root it will be a claim about the structure of our world and not just a modal claim.

This naturally leads to another suggestion: that all fundamental facts are general. On this view, the fundamental facts of the world are of the form

$$(\exists x)Fx, (\exists y)Gy, (\exists x)(\exists y)Rxy, (\exists x)(\exists y)\ x \neq y$$

and so on.[24] This suggestion is closer to what we want because it is at least a claim about the structure of our world. But as it stands it is unacceptable. After all, we have been brought up to understand that quantifiers range over a domain *of individuals*. So our natural understanding of the facts listed above is that they hold in virtue of facts about individuals, and it would therefore appear that we have made no progress.

Instead, what we want is a clear articulation of the fundamental facts of the world that "meshes" with the idea just mooted, namely that the structure of the world is fundamentally general. I call this approach 'generalism'. Before I develop it, let us pause to ask what this "mesh" requires.

[23] Lewis calls this view 'anti-haecceitism', and uses 'haecceitism' to label the view that there are purely individualistic differences between some possible worlds (Lewis 1986, p. 221). This terminology is the norm in one wing of the literature, but I hesitate to use it because other wings of the literature use this terminology to denote different distinctions.

[24] This may have been the view discussed (though not endorsed) by O'Leary-Hawthorne and Cover (1996), when they write that a theorist 'may insist that the full story about that world [can] be captured by general propositions, of the sort $(\exists x)(x \text{ is a sphere}), (\exists x)(\exists y)(x \text{ is a sphere and } y \text{ is a sphere and } x \neq y)$, and so on.' (p. 12). In this quotation they are talking about a possible world, but the analogous view about the actual world sounds very close to the view under consideration.

3.1 Desiderata on a new metaphysics

Assume for the moment that all possible general facts can be expressed in the language of predicate logic with identity but without constants. Call this language PL (I assume that PL contains no substitute for constants, such as predicates like '*x* Socratizes'). The generalist will claim that the fundamental facts of the world are those expressed by a different language G (for 'Generalism'). The idea is that when we would ordinarily describe a situation as being one in which a given sentence p of PL is true, the generalist will describe it as being a situation in which, fundamentally speaking, a certain sentence g of G is true. And vice-versa: when the generalist describes a situation with g, we would ordinarily describe it with p. When sentences of PL and G are related in this way I will call them "equivalent" (which is not the relation of *logical* equivalence since the sentences come from different languages).

Now, any metaphysician who paraphrases sentences of one language with sentences of another faces the question of what the relation of "equivalence" really consists in. This is an extremely delicate question, but to keep things tractable let me just state a necessary condition that the generalist puts on the relation: it must preserve the logical structure of each language. For instance, if a sentence g_1 of G is equivalent to $(\exists x)(Fx \,\&\, Gx)$, and if a sentence g_2 of G is equivalent to $(\exists x)Fx$, then it had better be the case that g_1 logically implies g_2. More generally:

> Preservation: Suppose a sentence g_1 in G is equivalent to a sentence p_1 in PL, and a sentence g_2 in G is equivalent to a sentence p_2 in PL. Then g_1 logically implies g_2 if and only if p_1 logically implies p_2.

The generalist will claim that the fundamental facts of the world are those expressed in a language G satisfying this constraint. But there are two further things required of G if generalism is to "mesh" with the idea that the world is fundamentally general. First, we require that G is rich enough to make sense of all possible general facts:

> Sufficiency: Every sentence of PL is equivalent to a sentence of G.

This is precisely where the bundle theory failed, for it could not make sense of a situation completely characterized by (A). But we also require that G describe no more structure than the structure of generality:

> Modesty: Every sentence of G is equivalent to a sentence of PL.

This is precisely where individualism fails, for there is no sentence of PL equivalent to '*That very individual* is red'. So by satisfying these desiderata, generalism attempts to sail between individualism and the bundle theory. In fact, generalism will stand to individualism in just the same way as a Galilean space-time structure stands to traditional conceptions of motion that make sense of absolute velocity. A Galilean space-time structure rejects absolute velocity but makes sense of all possible facts about relative velocity; likewise, a view satisfying

these desiderata will reject primitive individuals but allow one to make sense of all possible general facts.

Admittedly, I assumed above that all possible general facts can be expressed in PL. Given the expressive limitations of PL one may think that a more realistic assumption is that all possible general facts can be expressed in second-order logic, or perhaps an infinitary first-order logic of some degree. But rather than get sidetracked by this issue, I propose to continue with my (potentially) simplifying assumption as a working hypothesis in order to get a flavor of the sort of view that emerges. The extension of the current approach to other languages is a project for another time.

3.2 An algebraic approach

Indeed, even with this assumption in place there is more than one way to satisfy these desiderata, and I will not argue which is the best. Instead, I will just outline one view and call it 'generalism', ignoring for simplicity that this is only one way to execute this strategy.[25]

The generalist's ontology consists of a domain of properties, each with a given adicity. Properties of adicity greater than one might be better called relations, but I will use the term 'property' to cover them all.[26] Like the bundle theorist, our generalist thinks of these properties as universals rather than sets of individuals or tropes. To talk about these properties the generalist introduces to language G terms of the form $\boldsymbol{P^n}$ where $\boldsymbol{n}$ indicates the adicity of the property denoted. So, for example, we might use the term $\boldsymbol{F^1}$ to denote the 1-place property of being a friend.[27]

According to the generalist, the domain of properties instantiates a certain algebraic structure. To talk about this structure, she introduces six expressions to G: $\boldsymbol{\&}$, $\sim$, $\boldsymbol{c}$, $\boldsymbol{p}$, ι and $\boldsymbol{\sigma}$. Syntactically, they apply to terms to give a complex term—much like 'the father of x' in English applies to terms to give a complex term—so we can call them 'term-functors'. What do they mean? A complete and precise explanation requires some formal machinery, so to avoid getting bogged down I leave those details to the appendix. Here I will just impart the basic idea, in the hope that the benefits of brevity outweigh the costs of imprecision.

The most familiar term-functors are $\sim$ and $\boldsymbol{\&}$, which take properties and give their negations and conjunctions respectively. For example, if $\boldsymbol{F^1}$ is the 1-place property of being a friend and $\boldsymbol{G^1}$ is the 1-place property of being generous, then

[25] I am not aware of a view like generalism being proposed in the literature. The closest I have come across is a view discussed very briefly by Van Cleve in the last section of his (1985). It also bears some similarity with the 'ontological nihilism' of Hawthorne and Cortens (1995). The language G described here is borrowed from a language discussed by Quine (1976) and developed by Kuhn (1983). Burgess and Rosen (1997) discuss the prospects of using a language like this to pursue nominalism in the philosophy of mathematics, but the literature contains little discussion of the prospects of using it to formulate a generalist metaphysics.

[26] I should also say that the ontology will include properties of adicity zero which might more accurately be called 'states of affairs', but I will discuss this in more detail later on.

[27] For ease of prose I will be rather sloppy about the use-mention distinction in what follows. I do not think this will lead to any serious confusion.

$\sim \boldsymbol{F^1}$ is the 1-place property of not being a friend; $(\boldsymbol{F^1}\ \boldsymbol{\&}\ \boldsymbol{G^1})$ is the 1-place property of being a generous friend; and $(\boldsymbol{F^1}\ \boldsymbol{\&}\ \sim \boldsymbol{G^1})$ is the 1-place property of being a friend that is not generous.

The term-functors ι and $\boldsymbol{\sigma}$ are "permutative" expressions. They are used to achieve much the same effect as we achieve in PL by permuting the order of variables. For example, if $\boldsymbol{L^2}$ is the 2-place property of loving, which we ordinarily understand as holding between individuals x and y if and only if x loves y, then $\boldsymbol{\sigma L^2}$ is the 2-place property of being loved, which we ordinarily understand as holding between x and y if and only if y loves x. Thus, $(\boldsymbol{L^2}\ \boldsymbol{\&}\ \sim \boldsymbol{\sigma}\, \boldsymbol{L^2})$ is the 2-place property of loving unrequitedly, which we ordinarily understand to hold between individuals x and y if and only if x loves y and y does not love x.

What about $\boldsymbol{c}$? Well, if $\boldsymbol{L^2}$ is the 2-place property of loving, which we ordinarily understand as holding between individuals x and y if and only if x loves y, then $\boldsymbol{cL^2}$ is the 1-place property of being loved by someone, which we ordinarily understand as being instantiated by an individual y if and only if someone loves y. Very roughly, $\boldsymbol{c}$ partially "fills" a property by stating, as we ordinarily say, that something instantiates its first position. I will leave an explanation $\boldsymbol{p}$ and ι to the appendix, since they are not necessary to get an intuitive feel for the view.

In addition to these term-functors, the generalist also helps herself to a 2-place term $\boldsymbol{I^2}$ which denotes what we ordinarily think of as the relation of identity. Thus, $(\boldsymbol{L^2}\ \boldsymbol{\&}\ \sim \boldsymbol{I^2})$ is the 2-place property of loving another, which we ordinarily understand as holding between individuals x and y if and only if x loves y and $x \neq y$.

So the generalist claims that there is a domain of properties that instantiates the algebraic structure described by these term-functors. But what is the world *like*, according to the generalist? When we ordinarily describe a situation as being one in which someone loves someone, how does the generalist describe it? To answer this, consider the 1-place property $\boldsymbol{cL^2}$ just described, and consider the result of applying another $\boldsymbol{c}$ to get $\boldsymbol{ccL^2}$. This is a 0-place "property" that we might ordinarily understand as a state of affairs, namely the state of someone loving someone. Now '$\boldsymbol{ccL^2}$' is a term and, as such, it does not state anything about what the world is like. To state this, the generalist introduces to G the primitive predicate ***x obtains***, which applies to any 0-place term to produce a sentence. Thus, when we would ordinarily say that someone loves someone, the generalist says that $\boldsymbol{ccL^2}$ ***obtains***. Similarly, when we would ordinarily say that someone loves someone unrequitedly, the generalist says that $\boldsymbol{cc}(\boldsymbol{L^2}\ \boldsymbol{\&}\ \sim \boldsymbol{\sigma L^2})$ ***obtains***.

The generalist's view, then, is that the fundamental facts of the world all have the form

$$\boldsymbol{P^0}\ \textbf{\textit{obtains}}$$

where $\boldsymbol{P^0}$ is a 0-place property. The term $\boldsymbol{P^0}$ may of course be complex, formed from more basic terms along with applications of the term-functors.

Significantly, this view satisfies our three desiderata: in the appendix I outline how one can define a logic of consequence on sentences of G, and a relation of equivalence between sentences of G and PL, in such a way that PRESERVATION,

SUFFICIENCY, and MODESTY can all be met. Therefore, given *any* sentence p of PL, the generalist can produce an equivalent sentence of G that, according to her, expresses the fundamental nature of a situation that we would normally describe with p. As a result, the generalist is in no way committed to IOI, and in particular she can make sense of the possible world characterized by sentence (A) six pages back, a possible world that the bundle theorist could make no sense of.[28]

The generalist and the individualist therefore paint radically different pictures of the material world. The individualist tells us that there is a domain of individuals propertied and related in a certain way; while the generalist tells us that there are states of affairs that obtain, where these states of affairs are composed purely out of properties. Unlike the bundle theorist, the generalist makes no attempt to construct *individuals* out of properties. But it was never part of her remit to do so. The generalist's innovation is to say that the question 'What are individuals, if not primitive entities?' is the wrong question; that we should instead be asking for an account of the fundamental facts of the world that makes sense of all possible general facts without appealing to primitive individuals. By providing an account, she carves away primitive individuals while doing no damage to the space of possible general facts that can hold, just as a Galilean space-time carves away absolute velocity while doing no damage to the pattern of relative velocities that can be instantiated by a system. In this way, generalism is perfectly suited as a response to the problem of danglers.[29]

Note that generalism is a claim about the structure of the fundamental facts, and so is neutral on the status of sentences that may be thought to presuppose a domain of individuals. For example, consider everyday sentences such as

Ernest Hemingway is coming to tea,
Someone is coming to tea,

and philosophical sentences such as

Perceptual experiences present us with a world full of individuals.
If S believes that Ernest Hemingway is coming to tea, then S believes a proposition that contains an individual as a constituent.

Given any one of these sentences, the generalist might be an *error theorist* and say that it is false because it presupposes a domain of individuals that does not really exist; or she might instead be a *fictionalist* and say that it is literally false but true of a "fiction of individuals"; or she might be a *reductionist* and say that it is true in virtue of the underlying facts expressed by G; or she might be a *non-reductive realist* and say that it is true because it expresses the same thing as a sentence of G! Other options are available too, but the generalist need not take a stand either way.

I granted in Sect. 1 that there would be an onus on the generalist to account for the possibility of de re belief and the fact that perceptual experiences present us with a world full of individuals. We can now see how this onus might be discharged, for

[28] Incidentally, she expresses (A) with the sentence $\boldsymbol{cc(F^1 \,\&\, pF^1 \,\&\, \sim I)obtains}$.

[29] This is not to say that the generalist dispenses with danglers all together, for she may think that there is such a thing as absolute velocity! But the point is that she goes some way towards a dangler-less world-view by dispensing with primitive individuals.

as we have just seen generalism is (in and of itself) perfectly consistent with the truth of these claims.

3.3 The world is one

Before moving on to defend generalism from objections it will be important to note that, unlike individualism, generalism is *radically holistic*. To see why, it helps to first appreciate why individualism is atomistic. Consider a situation that an individualist would describe as containing exactly two primitive individuals, one of which is F and stands in relation R to the other one which is G, and suppose neither has any other properties. According to individualism, the fundamental facts about the situation are facts like

a is F, *b* is G, *a* bears R to *b*

And these facts together would characterize the situation entirely.

Some individualists would disagree with this last statement. They would argue that other facts are also needed to completely characterize the situation, such as the fact that *a* and *b* are distinct, the universal fact that everything in the situation is identical to *a* or *b*, and perhaps negative facts concerning the properties *a* and *b* do not have.[30] Fortunately, there is no need for us to take a stand on this issue: whichever facts the individualist adds to her initial list, she will still think that any situation can be characterized by a (potentially large) number of facts that together add up to give the situation as a whole. Since the situation as a whole is thought to be decomposable into parts, it is natural to call this an *atomistic* metaphysics.[31]

For the generalist, though, things are very different. How would she characterize the situation described above? One impediment to answering this question is that language G, in which she expresses the fundamental structure of the world, is foreign to most of us. However, Modesty says that any sentence of G is equivalent to a sentence of PL. So when discussing facts that the generalist believes to be fundamental and which she would express in G, it is harmless to express them in PL instead as a convenience to ourselves.

Given this convenience, the generalist would say that the above situation is characterized by the following fact:

$$(*) \quad (\exists x)(\exists y)(Fx \,\&\, Gy \,\&\, Rxy \,\&\, x \neq y)^{32}$$

Again, generalists may debate whether we would also need a conjunct in the matrix to specify that everything in the situation is identical to *x* or *y*, or negative conjuncts specifying what properties are not instantiated. But we need not settle the matter: whatever conjuncts the generalist adds to the matrix, she will not think that the

[30] See Russell (1985) and Armstrong (2004, Chaps. 5 and 6), for views of this kind.

[31] Russell (1985) was, of course, the classic atomist.

[32] For those readers familiar with G, the generalist will really state this as the fact that $\boldsymbol{cc(F^1 \,\&\, pG^1 \,\&\, R^2 \,\&\, \sim I^2)\ obtains}$.

situation is decomposable into "atomic" parts. After all, if she tried to replicate the individualist's decomposition, she would think that the atomic facts were something like:

$(**)$ $(\exists x)Fx, (\exists x)Gx, (\exists x)(\exists y)Rxy$[33]

But unlike the individualist's list, this leaves open whether something F stands in relation R to something else that's G, as is stated in (*), or the other way round. And it does not help to add other facts to (**), such as that $(\exists x)(\exists y)x \neq y$, for the resulting collection would still not determine whether or not the situation as a whole is as stated in (*).

As a result, the generalist thinks that the situation must be characterized by stating the single fact (*) all in one breath. Unlike the individualist, she cannot decompose the situation into atomic parts the sum of which give the situation as a whole. That is why I call generalism a *holistic* metaphysics. The "smaller" matters of fact listed in (**) still hold in the situation, but the generalist takes them to be derivative from the one fact (*).

This is a radical departure from pre-theoretic intuition. When I see my laptop and my cup on the table, I intuitively see the situation as being composed of many facts: my laptop being on the table, my cup being on the table, and so on. Add these facts up, I naturally think, and you get the entire situation. But according to generalism this is an illusion: the situation is fundamentally speaking a single whole. Indeed, generalism implies the striking claim that, fundamentally speaking at least, there is only One Great Fact that captures our entire world all at once! Contrary to pre-theoretic intuition, the world is not the logical sum of "smaller" matters of fact such as those listed in (**); rather, those facts are to be seen as derivative from the One Great Fact. According to the generalism, the world really is One.[34]

4 In defense of generalism

Let us recap. Individualism, remember, is the view that among the fundamental facts of the world are facts concerning what primitive individuals there are and what they are like. But I argued in Sect. 1 that

(1) It is a consequence of every physical theory considered over the past 400 years that primitive individuals are danglers.

I also argued that it is a point against a metaphysics if it implies that the world contains danglers. As I put it there,

[33] In G we would express these as the facts that $\boldsymbol{cF^1}$ ***obtains***, that $\boldsymbol{cG^1}$ ***obtains***, and that $\boldsymbol{ccR^2}$ ***obtains***.

[34] Schaffer (2007) has recently discussed a view he calls 'Monism'. On this view there is just one individual, the "world object"; or, at least, if there are other individuals they are to be thought of as derivative from the world object, which is the fundamental entity. Generalism and monism share some similarities, but notice that monism is, at least on the face of it, atomistic: the entire situation concerning the world object can be decomposed into the fact that it is F, the fact that it is G, and so on.

(2) Consider two theories about the structure of the material world, and suppose you discover that the first implies that the world contains a dangler while the other does not. All else being equal, it is rational for you to prefer the latter over the former.

I just now outlined generalism, according to which the world does not contain primitive individuals. Therefore, (1) and (2) imply that all else being equal, it is rational to prefer generalism over individualism—or at least, it is if anything like contemporary physical theory is to be believed.

Of course, all else might not equal: generalism differs in many respects from individualism, so it might turn out that the virtue of dispensing with individuals is not worth the cost. But in this section I will argue that

(3) The benefit that generalism enjoys over individualism in virtue of dispensing with danglers outweighs its putative costs.

Together, (1), (2) and (3) constitute my argument in favor of generalism. To defend (3), I will consider a number of putative costs that generalism might be accused of incurring.

4.1 Generalism is horribly complex

It is often said that simplicity is a theoretical virtue, and it may be complained that generalism fails dramatically on this count. One observation that may encourage this complaint is that most of us find it difficult to understand the language G (at least at first) since it contains term-functors that we are not familiar with. But does this mean that we should reject generalism? No: when we say that simplicity is a theoretical virtue, we do not mean that the theory should be easily understood. As Laplace put it, 'The simplicity of nature is not to be measured by our conceptions'.[35]

What, then, does simplicity as a theoretical virtue amount to? One thing it might mean is that a theory is simpler if its ontology contains fewer kinds of fundamental entities. But generalism scores well on this point, since its ontology are just properties. Another thing it might mean is that a theory is simpler if it contains fewer primitive bits of ideology. But generalism scores well on this point too, for G contains just six term-functors and the one primitive predicate. Yet another thing it might mean is that a theory is simpler if it contains fewer danglers—but of course generalism does better than individualism in this regard! I do not claim that this is all that 'simplicity' could amount to, but it is worth noting that at least on these points generalism does as well as individualism, if not better.

4.2 Generalism flies in the face of pre-theoretic belief

A second complaint one might have against generalism is that it revises our pre-theoretic conception of the world.

[35] Laplace, *Exposition du System du Monde*, quoted in Gribbin (2002, p. 298).

It is worth getting clear on the charge. If generalism revises pre-theoretic belief, this is *not* because it implies that sentences like 'Ernest Hemingway is coming to tea' are false. As I stressed in the last section, generalism is consistent with the truth of sentences like these; it just says that they are not true of the fundamental nature of reality. Instead, generalism is revisionary because it is holistic in the sense just outlined, while our pre-theoretic conception of the world is atomistic.

But does this give us reason to reject generalism? Not at all, for inquiry sometimes delivers surprises. The claim that the earth orbits the sun was once revisionary, but that in itself did not give our ancestors reason to reject it. What might be true is that we should not revise pre-theoretic belief without reason. But in this case we have a reason, namely that primitive individuals are danglers; according to (2), this is a reason to favor generalism.

4.3 Generalism is holistic, and this is a serious cost

Grant that if the holistic nature of generalism is objectionable, this is not because it flies against pre-theoretic belief. But might it be objectionable on other grounds? Hawthorne and Sider claim that it is a condition of adequacy on any metaphysics that it is atomistic.[36] But they do not say why this is so, and it is not obvious to me why holism should be ruled out by fiat.

One might worry that holism is bad because it rules out the possibility of local causal explanations. These are explanations that explain a given fact, say that a window broke, in terms of facts concerning the window's immediate vicinity, such as that a baseball collided with it.[37] The worry would be that if the world is holistic in our sense one cannot appeal to such "localized" matters of fact. But this worry confuses the sense in which a causal explanation is local, which concerns the *distance* between explanans and explananda, with the sense in which generalism is holistic, which concerns the logical structure of reality. Remember, even if the world is holistic in our sense, there are nonetheless general matters of fact concerning the trajectories of baseballs around windows, and holism allows that these are causally relevant to the fact that the window broke. All holism implies is that the world is not the logical sum of such facts.

4.4 Generalism cannot explain our pre-theoretic conception

Our pre-theoretic conception of the world is atomistic, but generalism is radically holistic. I just argued that this in itself is not a significant cost for the view, for inquiry regularly leads to surprises. But can the generalist explain why our pre-theoretic conception is so deeply ingrained in us? If not, I think this would indeed be a significant cost.

To appreciate the importance of the worry, compare our ancestors' discovery that the sun does not really rise, that really the earth rotates on its axis. It is easy for us to

[36] See Hawthorne and Sider (2002).

[37] A precise characterization of "local causation" would require much more fine-tuning, but this will do for our purposes.

forget how radical a break with pre-theoretic belief this discovery once was. Now, this break from pre-theoretic belief was not in itself a reason for our ancestors to doubt the discovery. But if the view that the earth rotates could not explain on its own terms why it looks to us as though the sun rises, I think this would have been reason to doubt the view. Of course, in that case an explanation is easily given. But in our case the worry is that we are missing something analogous: an explanation by the generalist of why it seems to us as though our world is atomistic when really it is not.

However, I think an explanation can be given, and I shall finish the paper by outlining it. The key is that thinking and reasoning about a holistic world is cognitively demanding, at least for creatures like us. The ability to think about the world atomistically, as if it contained a domain of primitive individuals, is pragmatically valuable. As a result, it is no surprise that we find it natural to think about the world in this way.

To see this, it is instructive to consider a fictional example. Consider a subject who thinks in a "language of thought": for this subject to believe that p is for her to believe a mental sentence s which means that p. And let us suppose that her mental language is G. According to the generalist, the structure of her thought mirrors the fundamental structure of the world. Now suppose she is investigating the properties of a physical system, and at an initial time t_0 her belief about the system consists in a belief in a mental sentence of the form ***P*$^{\mathbf{0}}$ *obtains***.

Once again, an impediment to discussing language G is that it is foreign to most of us. So I will pretend for convenience that our subject thinks in PL instead (remember, PL is predicate logic with identity but without constants). Given this convenience, we may suppose that at the initial time t_0 her belief about the system consists in a belief in the mental sentence

$$(\text{P1}) \quad (\exists x_1)\ldots(\exists x_{10})(Tx_1\ldots x_{10})$$

where T is some reasonably complicated predicate. Now suppose at t_1 she discovers that the system is in fact a little more complicated and she comes to believe the mental sentence

$$(\text{P2}) \quad (\exists x_1)\ldots(\exists x_{10})(Tx_1\ldots x_{10} \,\&\, Fx_{10})$$

Notice that to update her prior belief, she must come to believe this *entire* sentence. It is not sufficient for her simply to believe, say, the sentence $(\exists x)Fx$ in addition to (P1), for those two sentences do not entail (P2). The blame lies in the holism: since the situation cannot be decomposed into a collection of bite-sized facts, an agent cannot update her belief about one bite-sized fact, add it to what she already believes, and expect to have a unified view about the situation. Instead, our subject must update her state of belief *by believing a sentence that represents her entire world-view all at once*! Clearly, this places severe computational demands on belief revision.[38]

[38] I am slurring over some subtleties here. For one thing, there might be 'identifying descriptions' that would make her life easier. But there is little reason to think that such descriptions will be available in general. And in any case that method of information storage is extremely impractical: if our agent were to

But what if she were to think about the world differently? For each variable x_i she could introduce into her language of thought a *constant*, written a_i, which purports to refer to an individual. The beauty of this innovation is that the new language allows her think about the system as if it were decomposable into bite-sized facts. For at t_0 her belief about the system would have consisted in her believing many sentences such as

(C1) $T_1a_1, T_2a_2, \ldots, T_{10}a_{10}$

where the conjunction of these is the sentence $T(a_1 \ldots a_{10})$. And at t_1 she could update her beliefs by simply coming to believe the sentence

(C2) Fa_{10}

where (C2) is being used, along with the sentences listed in (C1), to conveniently represent the state of the system represented by (P2). Much better! So I suggest that if a subject really did live in the holistic world described by the generalist, it would be pragmatically useful to introduce constants into her language of thought that purport to refer to individuals. The resulting language would not accurately represent the underlying holistic structure of reality, but it would make her life a whole lot easier.

I just said that our subject uses (C2) and the sentences listed in (C1) to represent the state of the system represented by (P2); and, more generally, that she uses constants to represent the state of a holistic system in a convenient manner. It is worth asking what role the constants would need to have in order to perform this task. And the answer is: exactly the role they have in the introduction and elimination rules for the existential quantifier in ordinary predicate logic! Recall that these rules are:

$$\exists\textbf{-Intro}\quad \begin{array}{|l} P(a/x) \\ \hline (\exists x)P \end{array}$$

$$\exists\textbf{-Exit}\quad \begin{array}{|l} (\exists x)P \\ \hline \quad \begin{array}{|l} P(a/x) \\ \hline \\ \quad Q \end{array} \\ \hline Q \end{array}$$

(where ∃-Exit requires that 'a' does not occur in '$(\exists x)P$', 'Q', or any undischarged assumptions). Now suppose again that at the initial time t_0 our agent initially

Footnote 38 continued
discover that part of the identifying description is false she would have to revise every single belief about the thing she thinks satisfies the description!

believes the sentence (P1). To represent the system with constants, she reasons as follows:

1	$(\exists x_1)\ldots(\exists x_{10})(Tx_1\ldots x_{10})$	Initial belief (P1) at t_0
2	$T(a_1\ldots a_{10})$	Assumption
3	Fa_{10}	Empirical discovery at t_1

She can then continue to update her beliefs about the system, using the constants for as long as she wants. To recover what she has learnt in a form that is free of constants, she just needs to use the above rules:

4	$T(a_1\ldots a_{10})\ \&\ Fa_{10}$	2, 3, &-Intro
5	$(\exists x_1)\ldots(\exists x_{10})(Tx_1\ldots x_{10}\ \&\ Fx_{10})$	4, $\exists$-Intro
6	$(\exists x_1)\ldots(\exists x_{10})(Tx_1\ldots x_{10}\ \&\ Fx_{10})$	1, 2–5, $\exists$-Exit

where this conclusion is, notice, the sentence (P2). I take this to be a striking confluence: the very role that constants would need to play, if they were to allow her to navigate conveniently through a holistic world, is precisely the role that they are deemed to play in contemporary deductive logic!

My claim, then, is that it would be no surprise if our agent started to think in a language that purports to represent an atomistic world populated by individuals: thinking in such a language makes her life easier. This does not amount to a complete explanation of why *our* natural conception of the world is atomistic: the above story made various assumptions, and I am not proposing that at some point in history we "introduced" constants into our mode of thought. But the story helps make it unmysterious why creatures like us would end up thinking about the world atomistically, even if we really lived in the holistic world described by the generalist.[39]

I have discussed a number of putative vices that generalism might be accused of having, and in each case I have argued either that the accusation is incorrect, or that the putative vice is not such a vice after all. There may be other vices I have not considered, but this at least supports the view that

(3) The benefit that generalism enjoys over individualism in virtue of dispensing with danglers outweighs its putative costs.

[39] I should emphasize that the above story is not about the *semantics* of constants in our agent's language of thought. The claim is just that the pragmatic usefulness of constants explains why they exist in her mental language in the first place.

5 Conclusion

We naturally think of the material world as being populated with individuals, but I have argued that this conception is not true of the fundamental structure of reality. Individuals considered as primitive entities are objectionable on precisely the same grounds as absolute velocity: the physical laws of motion imply that both are danglers. This does not imply that we should dispense with primitive individuals: we still need a reasonable theory to adopt in its stead. But I outlined a theory that does without them and defended it from objections. In particular, I argued that it has the resources to explain on its own terms why our untutored conception of the world is so deeply ingrained in us. So perhaps we should stop taking our untutored conception at face-value and start taking seriously the possibility that we think that way because it is useful to think that way, and not because it is getting at the underlying truth.

Acknowledgements Thanks to Kit Fine for extensive discussions on these topics. Thanks also to David Brian Barnett, Ned Block, Jonny Cottrell, Hartry Field, Paul Horwich, Geoff Lee, Farid Masrour, John Morrison, Karl Schafer, Jonathan Schaffer, Stephen Schiffer, Michael Schweiger, Ted Sider, Peter Unger, Seth Yalcin, and participants of the NYU dissertation seminar during the spring of 2008 for extremely helpful comments on earlier drafts of this paper.

Appendix on language G

First I will define the syntax of language G and give a more complete and precise explanation of what the term-functors mean. Then I will define a notion of logical implication on G and a relation of equivalence between G and PL. Third, I will outline the proof that the relation of equivalence satisfies SUFFICIENCY, MODESTY, and PRESERVATION, as required. Finally, I will respond to an objection to the way these tasks are carried out.

The syntax of G

The vocabulary of G consists of a countable set of atomic terms, each associated with an integer $n \geq 0$, including a term $\boldsymbol{I^2}$ associated with the number 2. If a term of G is associated with the integer n, we call it an n-place term. The vocabulary of G also includes six term-functors $\boldsymbol{\&}$, $\sim$, $\boldsymbol{c}$, $\boldsymbol{p}$, ι, and $\boldsymbol{\sigma}$. The set of terms are then defined inductively as follows:

1. All atomic n-place terms are n-place terms.
2. If $\boldsymbol{P^n}$ and $\boldsymbol{Q^m}$ are n-place and m-place terms respectively, then
   (a) $\sim\boldsymbol{P^n}$, $\iota\boldsymbol{P^n}$, and $\boldsymbol{\sigma P^n}$ are n-place terms,
   (b) $\boldsymbol{cP^n}$ is an $(n - 1)$-place term unless $n = 0$, in which case it is a 0-place term.
   (c) $\boldsymbol{pP^n}$ is an $(n + 1)$-place term, and
   (d) $(\boldsymbol{P^n \,\&\, Q^m})$ is a $max(n, m)$-place term.

3. That's all; nothing else is a term.

Finally, the vocabulary of G includes a single predicate, ***x obtains***. A sentence of G is an expression of the form $\boldsymbol{P^0}$ ***obtains***, where $\boldsymbol{P^0}$ is a 0-place term.[40]

The term-functors

In the text I gave a partial explanation of what the term-functors mean by saying things like 'if $\boldsymbol{L^2}$ is the 2-place property of loving, which we ordinarily understand as holding between individuals x and y if and only if x loves y, then ($\boldsymbol{L^2}$ **&** $\sim\boldsymbol{\sigma L^2}$) is the 2-place property of loving unrequitedly, which we ordinarily understand to hold between individuals x and y if and only if x loves y and y does not love x.'

Here I shall give a more precise and general explanation of what the term-functors mean in this form. But there are two points worth keeping in mind. First, I am explaining what the term-functors mean in terms that we ordinarily understand, namely in terms of individuals. But of course this is just an explanatory convenience, and we should keep in mind that the properties are ultimately to be understood independently of a domain of individuals. For a discussion of the legitimacy of this explanatory technique, see the end of this appendix. The second thing to keep in mind is that in the above quotation from the text the 'if and only if' is not a material bi-conditional—if it were, it would not allow me to pick out the intended properties. I shall not discuss exactly what bi-conditional it is, but I take it that we understand the quotation above well enough to be getting on with.

Now for the explanation of the term functors. Let $\boldsymbol{P^n}$ be the n-place property we ordinarily understand as holding of individuals $x_1 \ldots x_n$ if and only if $\phi(x_1 \ldots x_n)$. And let $\boldsymbol{Q^m}$ be the m-place property we ordinarily understand as holding of individuals $y_1 \ldots y_m$ if and only if $\psi(y_1 \ldots y_m)$. Then

1. $\sim\boldsymbol{P^n}$ is the n-place property we ordinarily understand as holding of $x_1 \ldots x_n$ if and only if it is not the case that $\phi(x_1 \ldots x_n)$;
2. ($\boldsymbol{P^n}$ **&** $\boldsymbol{Q^m}$) is the $max(n, m)$-place property that we ordinarily understand as holding of $x_1 \ldots x_k$ if and only if $\phi(x_1 \ldots x_n)$ and $\psi(x_1 \ldots x_m)$, where $k = max(n, m)$;
3. $\boldsymbol{\sigma P^n}$ is the n-place property we ordinarily understand as holding of $x_1 \ldots x_n$ if and only if $\phi(x_n\ x_1\ x_2 \ldots x_{n-1})$;
4. $\boldsymbol{\iota P^n}$ is the n-place property we ordinarily understand as holding of $x_1 \ldots x_n$ if and only if $\phi(x_2\ x_1\ x_3 \ldots x_n)$;
5. If $n \geq 1$, then $\boldsymbol{cP^n}$ is the $(n - 1)$-place property that we ordinarily understand as holding of $x_2 \ldots x_n$ if and only if there is something x_1 such that $\phi(x_1 \ldots x_n)$; otherwise $\boldsymbol{cP^n}$ is the 0-place property $\boldsymbol{P^n}$;
6. $\boldsymbol{pP^n}$ is the $(n + 1)$-place property that we ordinarily understand as holding of $x_1 \ldots x_{n+1}$ if and only if $\phi(x_2 \ldots x_n\ x_{n+1})$.

Finally, $\boldsymbol{I^2}$ is identity, the 2-place property we ordinarily understand as holding between x and y if and only if x is identical to y.

[40] One could expand G to include sentential connectives, variables and quantifiers ranging over properties, modal operators and so on, but I shall not explore these expansions here.

Predicate functor logic

Our task now is to define a relation of logical consequence on G and a relation of equivalence between G and PL in such a way that we can prove SUFFICIENCY, MODESTY, and PRESERVATION. We shall reduce this task to one already accomplished by defining a closely related language of "predicate functor logic" I will call Q.[41] There is already a well-defined relation of consequence on Q and a relation of equivalence between Q and PL for which analogues of these three theorems hold, and we will use this fact to induce corresponding relations on G and prove our theorems.

Syntactically speaking, the language Q is just the same as G with the exception that (i) it does not contain G's single predicate ***x obtains***, and (ii) its expressions are written in normal font rather than the bold font of G. The terms in G are, when written in the normal font of Q, to be understood as predicates instead. More precisely, the vocabulary of Q consists of a countable set of atomic n-place predicates, including a 2-place predicate I^2, and six predicate functors $\sim$, &, c, p, ι and σ. An expression of the form P^n is an atomic n-place predicate of Q if and only if $\boldsymbol{P^n}$ is an atomic n-place term of G; an expression of the form $\sim P^n$ is an n-place predicate of Q if and only if $\sim \boldsymbol{P^n}$ is an n-place term of G; and so on.

We can define a notion of logical implication on Q model-theoretically. Without loss of generality, we can assume that the predicates of Q are the predicates of PL. So we can give a semantics for Q using the standard models of PL (i.e. predicate logic with identity but without constants).[42] These models are pairs of the form $M = (D, v)$, where D is a non-empty set and v is a function from n-place predicates (other than I^2) to sets of n-tuples of D. Given a predicate P^n of Q, a model $M = (D,v)$ and a sequence $d = (d_1, d_2\ldots)$ of elements of D, we say that *d satisfies* P^n in M, written $d \models_M P^n$, if and only if

1. If P^n is atomic then $(d_1, \ldots, d_n) \in v(P^n)$,
2. If $P^n = I^2$ then $d_1 = d_2$,
3. If $P^n = \sim Q^n$ then it is not the case that $d \models_M Q^n$,
4. If $P^n = (Q^m \,\&\, R^r)$ then $d \models_M Q^m$ and $d \models_M R^r$,
5. If $P^n = c\, Q^{n+1}$ then there is an $x \in D$ such that $(x, d_1, d_2, \ldots) \models_M Q^{n+1}$,
6. If $P^n = p\, Q^{n-1}$ then $(d_2, d_3, \ldots) \models_M Q^{n-1}$,
7. If $P^n = \iota Q^n$ then $(d_2, d_1, d_3, d_4, \ldots) \models_M Q^n$, and finally
8. If $P^n = \sigma Q^n$ then $(d_n, d_1, d_2, \ldots, d_{n-1}, d_{n+1}, \ldots) \models_M Q^n$.

We can then say that P^n *is true on* M, written $\models_M P^n$, if and only if $d \models_M P^n$ for all sequences $d = (d_1, d_2,\ldots)$ of elements of D.

With this semantics in place, it is now easy to define a relation of logical implication on Q and a relation of equivalence between Q and PL. First, the relation of logical implication can be defined as follows: a predicate P^n *logically implies* a predicate Q^m, written $P^n \models Q^m$, if and only if for any model M, if $\models_M P^n$ then $\models_M Q^m$.

[41] The name is in deference to Quine, who brought it to the attention of philosophers in his (1976). The language Q has been explored subsequently by Kuhn (1983).

[42] The following semantics is borrowed from Kuhn (1983).

Now for the relation of equivalence between Q and PL. Remember, the models $M = (D, v)$ are models of PL too. So let us assume that the notion of an n-ary formula $\phi(x_1 \ldots x_n)$ of PL being true on a model M, written $\models_M \phi(x_1 \ldots x_n)$, is defined in the normal way.[43] Then we can say that an n-ary formula $\phi(x_1 \ldots x_n)$ of PL and a predicate P^n of Q are *equivalent* if and only if for every model M, $\models_M \phi(x_1 \ldots x_n)$ if and only if $\models_M P^n$.

For our purposes the important results are these:

Q-Sufficiency Every n-ary formula of PL is equivalent to some n-place predicate of Q.

Q-Modesty Every n-place predicate of Q is equivalent to some n-ary formula of PL.[44]

With these results in hand, our task is now easy.

Implication, equivalence, and our three theorems

First, we use Q to define a relation of consequence on G and a relation of equivalence between G and PL. Then we prove our three theorems.

The relation of logical implication on Q naturally induces a relation $\preceq$ between terms of G: $\boldsymbol{P^n} \preceq \boldsymbol{Q^m}$ if and only if $P^n \models Q^m$. In turn, this induces a relation of logical implication on sentences of G: $\boldsymbol{P^0}$ ***obtains*** *logically implies* $\boldsymbol{Q^0}$ ***obtains***, written $\boldsymbol{P^0}$ ***obtains*** $\models \boldsymbol{Q^0}$ ***obtains***, if and only if $\boldsymbol{P^0} \preceq \boldsymbol{Q^0}$; that is, if and only if $P^0 \models Q^0$. (The sign '$\models$' is being used for logical implication in both languages, but I take it that no confusion will result.)

The relation of equivalence between Q and PL also induces a relation of equivalence between G and PL: a sentence $\boldsymbol{P^0}$ ***obtains*** of G is *equivalent* to a sentence p of PL if and only if P^0 is equivalent to p.

Preservation is now easy to prove. Suppose a sentence $\boldsymbol{P^0}$ ***obtains*** in G is equivalent to a sentence p in PL, and suppose a sentence $\boldsymbol{Q^0}$ ***obtains*** in G is equivalent to q in PL. We must show that $\boldsymbol{P^0}$ ***obtains*** $\models \boldsymbol{Q^0}$ ***obtains*** if and only if $p \models q$. Now, $\boldsymbol{P^0}$ ***obtains*** $\models \boldsymbol{Q^0}$ ***obtains*** if and only if $P^0 \models Q^0$ (by definition of implication in G). But P^0 is equivalent to p and Q^0 is equivalent to q (by our hypothesis and the definition of equivalence between G and PL), and therefore $P^0 \models Q^0$ if and only if $p \models q$ (by model-theoretic reasoning). So $\boldsymbol{P^0}$ ***obtains*** $\models$ $\boldsymbol{Q^0}$ ***obtains*** if and only if $p \models q$, as required.

Finally, Sufficiency and Modesty follow straight from Q-Sufficiency and Q-Modesty along with the above definitions.

[43] Roughly speaking, we say that the formula is true on the model if and only if it is satisfied by every sequence in the model. To define the notion of a formula being satisfied by a sequence in the model, we need a way to associate free variables in the formula with objects in the sequence. Here we can simply use the convention that the i'th free variable is associated with the i'th object in the sequence.

[44] To prove these, define translation functions from n-ary formulas of predicate logic to n-place predicates of Q and vice versa, and then prove that the value of each function is always equivalent to the argument. For one example of translation functions like this see Kuhn (1983).

Using a domain of individuals

Earlier in the appendix and in the text I explained what the term-functors of G mean by appealing to our ordinary understanding of properties being instantiated by a *domain of individuals*. But the generalist claims that individuals are not constituents of the fundamental facts of the world. So was that method of explanation legitimate?

Similarly, I just used the semantics for Q to define a relation of implication on G and a relation of equivalence between G and PL. But the semantics for Q used ordinary models of PL of the form $M = (D, v)$, where D is a *domain of individuals*. Was that legitimate?

I think it was. The key is to distinguish between metaphysical and conceptual priority. Metaphysically, the generalist claims that the fundamental facts of the world are those expressed by G. But conceptually, I have explained the view to you in terms that you are familiar with, namely in terms of individuals. Once you are competent with G you can then, if you so wish, become a generalist by giving up your understanding of G in terms of a domain of individuals and simply taking the term-functors and predicate of G as undefined primitives.

There is no space to defend the cogency of the strategy here in full. I shall only plead innocence by association, for there are many other cases in which we adopt it. The case of velocity is, unsurprisingly, a good example. Our ordinary concept of the relative velocity between two material things is defined as the difference between their absolute velocities. Once you are competent with the concept, you can then (if you so wish) dispense with absolute velocity and either think of relative velocity as a primitive concept or define it in other terms. And this is precisely what we do when we adopt a Galilean conception of space-time.

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