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# Fundamentality physicalism

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## ABSTRACT

This essay has three goals. The first is to introduce the notion of *fundamentality* and to argue that physicalism can usefully be conceived of as a thesis about fundamentality. The second is to argue (i) for the advantages of fundamentality physicalism over modal formulations and (ii) that fundamentality physicalism is what many who endorse modal formulations of physicalism had in mind all along. Third, I describe what I take to be the main obstacle for a fundamentality-oriented formulation of physicalism: ‘the problem of abstracta’, which asks how physical can accommodate phenomena such as mathematics and universals, and which modal formulations do not face. I canvas three solutions: the inapt for ground solution, the concrete restriction, and the contingency restriction.



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## 1. Fundamentality

### 1.1. *The building blocks of reality*

The world has more and less fundamental aspects. Quarks, leptons, bosons, and their masses, charges, and spins, are likely among the fundamental aspects. Coffees, cars, and koalas are not. The world’s fundamentalia constitute the bedrock of reality. The non-fundamental contents of the world *metaphysically depend* on the fundamental. The coffees, cars, and koalas are the way they are because of the way the fundamentalia are. With the distinction between the fundamental and the non-fundamental in place, an obvious question arises: ‘What is fundamental?’ This is one of the most natural questions in all of human inquiry. For the most part, physics, tinged with some philosophy, is in the business of answering it.

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Fundamentalia are the basic building blocks of reality.<sup>1,2</sup> We need to separate two questions about the fundamental. *The roster question* asks: ‘What types of fundamentalia are there?’ *The layout question* asks: ‘What tokens of fundamentalia are there, and how are they?’ The roster questions asks what building blocks there are. The layout questions asks how they are arranged. Once we’ve decided that electrons and their spins are fundamental (thereby partly answering the roster question), there remain layout questions about how many electrons there are, where they are, what spins they have, and the like. Fundamentalia come in many varieties. At the least, there are objects, properties, and laws. (‘Properties’ should be understood to include relations of any adicity.) There may be other varieties, but the types I’ve mentioned seem like a good start.

It was once thought that atoms were fundamental. This has turned out not to be so. Atoms are constructed from combinations of electrons, protons, and neutrons, along with some forces keeping them together. Neither protons nor neutrons are fundamental. They are composed of still smaller particles. The best science at this moment – the standard model – still suggests that electrons are fundamental, though there are open questions about whether each electron is merely a vibration in a string, or a point assigned property values in a field. The details of these proposals need not concern us.

I think there is a perfectly respectable notion of ‘metaphysical building block’. Helping myself to the currently vogue terminology of ‘ground’ (Schaffer 2009, 2010; Rosen 2010; Fine 2012, and the essays in Correia and Schneider 2012; Bliss and Priest 2018), I will say that the building blocks of reality *ground* everything else. Everything else metaphysically depends, for its existence and features, on its grounds. Here, ‘grounds’ functions as the linguistic converse of ‘metaphysically depends on’:  $x$  grounds  $y$  if and only if  $y$  metaphysically depends on  $x$ . Metaphysical dependence, like ground, is distinct from other forms of dependence, including causal, modal, and epistemic dependence. If the reader is unhappy with the idea of ground, they should substitute ‘ $x$  metaphysically depends on  $y$ ’ for every statement of the form ‘ $y$  grounds  $x$ ’.

My notion of ‘metaphysical building block’ is something like a generalization of the everyday notion of ‘building block’. Consider a lego model of

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<sup>1</sup>This paper assumes that there is a maximally fundamental level. One might instead think that there is no bottom. On such a picture, each level is underpinned by further, more fundamental structure. One might call such a scenario ‘infinite descent’. Not much turns on this issue. However, it is easier to speak as if there is a maximally fundamental level, so I shall continue to make the assumption.

<sup>2</sup>Cf. Tahko (2018) for a nice overview of thought about fundamentality.

the Space Shuttle *Endeavour*. The model is constructed from the individual legos that form its wings, tail, fuselage, and cockpit. These legos, in turn, are constructed from molecular plastic compounds. The lego spaceship is the way it is in virtue of the way the individual legos are, which are the way they are because of the way the plastics are, which, eventually, are the way they are in virtue of how the sub-atomic particles in the vicinity of the spaceship are. However, the state of the lego spaceship is not merely determined by the pieces, the *objects*, that make it up. It is also determined by *how* those pieces are, i.e. by what properties they have. It is the having of properties by those sub-atomic particles that generates the molecules, compounds, lego pieces, and eventually the *Endeavour* model itself.

Talk of fundamentalia as ‘building blocks’ should not be taken overly literally. Fundamentalialia need not be, in any reasonable sense, *part* of the non-fundamentalialia they ground. Deists believe that there is one fundamental: God. But they need not believe that God is literally a *part* of everything. Physicalists can claim that physical states ground mental states, without claiming that those physical states are part of those mental states.<sup>3</sup>

One can get a grip on the notions of fundamentality and ground by imagining oneself tasked with the job of creating the universe. One must create all the various fundamental particles, assign those particles fundamental properties, and set out the laws that govern their interaction. In so doing, one also creates the non-fundamentalialia: the coffees, cars, and koalas. The creation of the koala is not an additional act. Compare to the creation of the lego model. Once you arrange all the legos appropriately, you’re done. There is no additional task of creating the toy spaceship itself. Let us call the test for fundamentality embodied in this thought experiment *the creation test*. Something is fundamental at world *w* if and only if it would need to be directly created by a builder of *w*. A creator can indirectly create koalas by creating appropriately arranged fundamentalialia. But the fundamentalialia must be created directly because they are not metaphysically dependent upon anything further.

## 1.2. *The relata of ground*

What are the relata of ground? We might remain agnostic, adopting a strategy similar to Fine (2012). Finean agnosticism permits one to make

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<sup>3</sup>Thanks to an anonymous referee for suggestions here. For further discussion of why one should not think of grounding, or fundamentality, in terms of parts, cf. Rabin (ms).

statements of the form ‘sentence<sub>1</sub>, sentence<sub>2</sub>,...grounds sentence<sub>3</sub>’, without making commitments about what the genuine relata of ground are, or reifying the grounding relation itself. One need claim only that statements of the above form are true.

However, I’m offering a metaphysical picture and an approach to fundamentality. Such pictures are better fleshed out and more informative when they are more committal, even if those commitments come with warts. At the least, I take there to be relations of metaphysical grounding between *facts*, conceived of as something like states of affairs. A fact is a specific way the world is. Facts include the having of properties by objects and the holding of laws. The fact that these electrons and protons are organized thus and so, with these charges and masses, metaphysically grounds the fact that the atom has the mass it does. Some facts are more fundamental than others. The facts that are grounded by no further facts are the fundamental facts.<sup>4</sup> One might also count as fundamental whatever is involved in those states of affairs: objects, properties, events, laws, what have you. Ground relates a plurality of facts to a single fact. (The plurality can contain only one element). Together the grounding facts make it the case that the grounded fact obtains. One might also wish to posit relations of ground between objects, events, properties, property instances, or items of other categories. Perhaps the electrons and protons ground the atom. I have no opposition to such claims. But on them I remain officially agnostic.

This paper discusses a wide variety of stuff. It will be useful to have a neutral term that includes items from any category. I choose ‘phenomenon’. This seems appropriate. The world contains a tremendous variety of phenomena. Some are straightforwardly physical (leptons and mass); some are not (experiences of red, laws of a nation). *Fundamentality physicalism* says that all these phenomena ultimately depend upon the physical.

### 1.3. *The covering constraint*

The layout question asks how the building blocks of reality are arranged. A complete answer to the layout question will tell us how every particular fundamental is. The complete layout of fundamentalia has an important feature, expressed in *the covering constraint*:

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<sup>4</sup>We see a relaxing of this requirement in Section 4.3. In the case of ‘infinite descent’, in which there is no bottom level of ungrounded facts, there are a variety of alternative ways to conceive of fundamentality. Cf. Tahko (2014). For formulating physicalism, infinite descent poses no significant obstacle. Rather than claiming that the bottom level is physical, the physicalist can claim instead that beyond a certain depth, everything is physical. Cf. also Montero (2006).

- *The Covering Constraint*: All of reality depends on reality's fundamental layout.<sup>5</sup>

The basic idea of the covering constraint is that the fundamental layout is metaphysically responsible for all of reality. It *covers* the entire world. In the ideology of ground, the covering constraint entails that everything is either a fundamental or grounded in some fundamental(s). In fact-talk: Every fact is either fundamental or grounded in fundamental facts. I take some version of the covering constraint to be constitutive of the notion of fundamentality.

Claims about the fundamental have modal import. This is an extra claim that is, strictly speaking, separable from the bare notion of fundamentality itself. But I endorse the modal implications of fundamentality, and discussing them will both help the reader grip the notion of fundamentality and to make connections to extant philosophical theorizing about fundamentality and physicalism, which has often been couched in the language of modality. The modality of which I speak is *metaphysical modality*, which I take to represent all the different ways a (possible) world could be.

I said above that the layout of the world's fundamental constituents grounds the remainder of the world. Suppose that the world's fundamental level is composed of three types of particles – quarks, leptons, and bosons, some fundamental properties and relations, and laws that govern those particles, properties, and relations. On this assumption, once you fix the distribution of quarks, bosons, and leptons across space-time, assign them their fundamental properties and relations, and set in place the laws that govern their interaction, you thereby fix the entire state of the world.

This talk of 'fixing' can be made more specific using modal tools. The modal version of the covering constraint can be expressed as follows:

- *Modal Covering Constraint*: No two possible worlds differ without differing fundamentally.

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<sup>5</sup>Schaffer (2010, 38–39) discusses a similar constraint, which he titles 'the tiling constraint'. Schaffer's tiling constraint involves two components. The first is roughly equivalent to my covering constraint. The second is a 'no overlap' clause. Schaffer claims that there are enough fundamentalia to cover all of reality, and no extras. Schaffer's 'no overlap' clause makes more sense within the mereological framework within which he operates. However, I'm disinclined toward a no overlap constraint. I don't see why two fundamentalia couldn't do 'unnecessary work', in the sense of one fundamental grounding some non-fundamental that another fundamental also grounds. A creator who builds a world with two fundamentalia that overlap by doing the same metaphysical job creates a less elegant world than his rival who builds without overlap. But the world is not always elegant.

Contrapositively, any two worlds that are fundamentally identical are completely identical. You cannot get an extra koala without adding some extra quarks, leptons, and bosons.

## 2. Fundamentality physicalism

### 2.1. *Fundamentality physicalism and the roster question*

The roster question asks, 'What types of fundamentalia are there?' Various answers have been proposed. *Fundamentality deism*: there is one fundamental – God. *Fundamentality idealism*: all fundamentalia are mental. Physicalism is another popular thesis, and the current frontrunner for the true theory of the world's fundamental level. *Fundamentality physicalism* says that all the world's fundamentalia are physical. I'll take *fundamentality dualism* to be the thesis that the world's roster of fundamentalia contains two types of phenomena: physical and mental. (For brevity, I often omit the qualifier 'fundamentality'.)

Fundamentality dualism can take many forms. Potential mental fundamentalia include consciousness particles, mental properties ('represents that P', 'experiences pain'), or fundamental psycho-physical laws of the universe that characterize relations between the mental and the physical (Chalmers 1996, 2003). For the most part, the discovery of reality's fundamentalia falls to physics, especially theoretical and particle physics. Physics seems to suggest something like physicalism (though this claim is not uncontroversial). It has not postulated any consciousness particles yet.

### 2.2. *In search of the physical*

There are long-standing and well-known issues surrounding the attempt to clarify what exactly 'physical' means in physicalism's claim that 'everything is physical'. Hempel (1945) forcefully pressed his famous dilemma, arguing that physicalism is either false or trivially true. Many have weighed in on the issue since (Dowell 2006a, 2006b; Wilson 2006; Worley 2006; Stoljar 2009a, 2009b). On my account, something is physical if it is either a physical fundamental or grounded therein. But this merely moves the bump in the rug. What does it take for a fundamental to count as physical?

Officially, fundamentality physicalism can remain (mostly) neutral on the topic of characterizing the physical. It is committed to the idea that one should first characterize a more limited and austere sense of 'physical':

that of a physical fundamental; the broader notion of physicality follows: ‘physical fundamental or dependent thereon’. (For more on the ‘two senses’ of physical, cf. Wilson 2005; Rabin 2013, Chapter 1). Beyond that fundamentality physicalism remains agnostic on ‘the physical’. Theorists can plug in their favored conception. However, I do have positive views about how one should characterize the physical. This seems as good a place as any to take my stand. But the reader should keep in mind that my view about the physical – primitivism – is separate from the claim that physicalism is best formulated using fundamentality.

### 2.3. Three ways to be physical

Everyone agrees that, if consciousness is fundamental, then physicalism is thereby falsified. In this sense, at least, consciousness is non-physical. Clearly, our world contains consciousness. Yet I endorse physicalism, which says that all the world’s contents are physical. These three claims seem inconsistent. What gives? Resolving the tension requires first making a familiar distinction between what I will call the *broadly* and the *narrowly* physical.<sup>6</sup> Something is *broadly physical* iff it depends (in a yet to be spelled out sense) on narrowly physical phenomena. Something is *narrowly physical* iff it is part of the physical base on which all else depends. This schema can be wielded by a wide variety of different formulations of physicalism. (For details cf. Rabin 2013, 1.4.) The relation of dependence could be realization, supervenience, ground, identity, or something else. Fundamentality physicalism says that the narrowly physical phenomena are the physical fundamentalia. If physicalism is true, consciousness is broadly, but not narrowly physical. But this does not yet solve the dilemma with which we started. Both consciousness and molecules are broadly physical. But there remains a sense in which molecules are physical but consciousness is not. Something is *conceptually physical* iff were it part of the world’s base, physicalism would not thereby be falsified. I have spoken about ‘the base’. Obviously, I think the base is the world’s fundamental level. But other notions of a ‘base’ are available: one could have a supervenience or a realization base.

We now have the resource to divide molecules, consciousness, and quarks. Quarks are both conceptually and narrowly physical, i.e. fundamental. Molecules are conceptually and broadly, but not narrowly, physical. They are not fundamental. But if they were, physicalism would

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<sup>6</sup>The same distinction appears in Wilson (2006).



remain unscathed. In contrast, consciousness and other mental phenomena are broadly, but not conceptually, physical.

When offering a characterization of 'the physical', what one is characterizing is the conceptually physical. What are the phenomena that, if basic, would not challenge physicalism? My answer is anti-climactic: primitivism.

#### ***2.4. Primitivism about the physical***

I endorse conceptual primitivism about the (conceptually) physical. (From here I omit the rider 'conceptually'). By 'conceptual primitivism' about the physical, I mean that I will not attempt to give necessary and sufficient conditions, in other terms, for when something is or is not physical. Conceptual primitivism should be contrasted with metaphysical primitivism, which alleges metaphysical fundamentality. I also endorse metaphysical primitivism about some physical phenomena (e.g. quarks). But the two primitivisms are independent. Stoljar (2009b) argues that necessary and sufficient conditions for physicality cannot be given in other terms, and that this result robs physicalism of its interest as a philosophical thesis. I am inclined to agree that necessary and sufficient conditions cannot be given. But I disagree that this robs physicalism of its importance.<sup>7</sup> One can explicate a notion with defining it. I offer paradigm examples of physical phenomena: quarks, charge, pressure. I offer paradigm examples of non-physical phenomena: consciousness, representation, chi, ectoplasm (which need not be mental). Physical properties can often (though not necessarily always) be characterized mathematically, using magnitudes. They enter spatio-temporal and causal relations to other physical phenomena. All the entities currently studied by physics are physical. I think we have a good, if rough and ready, grasp on what kinds of fundamentalia jeopardize fundamentality physicalism. Fundamental quarks, mass, and photons do not count against fundamentality physicalism. Fundamental experiences of red, representations that P, ectoplasm, and consciousness particles do. We know the physical, and the non-physical, when we see it, even if we cannot give conditions for (conceptual) physicality in other terms.

Stubborn readers will refuse to acknowledge that I have characterized a notion of the 'the physical' that is up to the task at hand: explicating fundamentality physicalism. I don't have much to say to such readers, other than to request that they think further about the issue and ask themselves

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<sup>7</sup>For more on this disagreement between Stoljar and I, cf. Rabin (2011).

whether they are asking too much. I have admitted that it is difficult to give necessary and sufficient conditions for physicality in other terms. But I do not take the situation to be much different with our grasp of most concepts, including ‘coffee’, ‘car’, and ‘koala’. It is notoriously hard to give necessary and sufficient conditions for being a C for almost any concept C. The concept ‘physical fundamental’ is no different. But this does not render physicalism or fundamentality physicalism meaningless or trivial any more than the inability to give necessary and sufficient conditions for coffee-ness or koala-hood makes the claim that the building contains fifty coffees and/or koalas meaningless or trivial. In the end, what matters is what the roster of fundamentalia is, and not whether those fundamentalia count as physical, mental, or what-have-you. However, labels such as (fundamentality) ‘physicalism’, ‘dualism’, and ‘idealism’ are useful for characterizing broad classes of theories about the fundamental nature of our world.

### 3. Modal physicalism

In recent times, physicalism/materialism has often been categorized in modal terms. Modal definitions appear in Chalmers (1996), Leuenberger (2008), Lewis (1983), Jackson (1993), Stoljar (2009b, 2009a), Papineau (2002), and elsewhere. This section argues that fundamentality physicalism is preferable to these popular modal definitions. My argument has two prongs. The first prong is straightforward: there are counterexamples to modal physicalism that are not counterexamples to fundamentality physicalism. Modal physicalism declares physicalism to be true at worlds that are, intuitively, not physicalist. Fundamentality physicalism gets the verdict correct about these worlds. The second prong is conceptual: fundamentality physicalism is conceptually prior to modal physicalism.

#### 3.1. From modality to fundamentality: the conceptual route

##### 3.1.1. Simple modal physicalism and the problem of extras

The basic idea behind Modal Physicalism is this: copy the actual world in all its physical aspects, and you thereby copy the world in all its aspects. Here is a simple formulation that captures this thought:

*Simple Modal Physicalism:* Every possible world that is a physical duplicate of the actual world is a duplicate *simpliciter*.

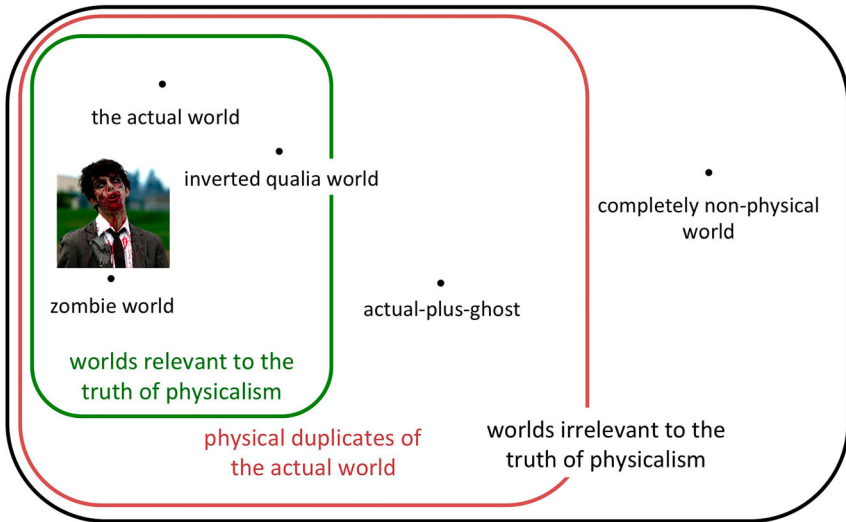
Unfortunately, it has been generally acknowledged that this definition, while elegant, does not work. It cannot deal with *the problem of extras*. (The problem has also been called 'the epiphenomenal ectoplasm problem'. Cf. Horgan 1982; Lewis 1983; Stoljar 2009a, 4.3.) Consider the world *Actual-plus-Ghost*, a physical duplicate of the actual world that has an additional 'extra': a ghost that travels through space-time observing, but never interacting with, the physical realm. Physicalism about *Actual-plus-Ghost* is clearly false. It contains non-physical ghosts. But the mere metaphysical possibility of *Actual-plus-Ghost* should not challenge physicalism about the actual world. Unfortunately, the metaphysical possibility of *Actual-plus-Ghost* falsifies simple modal physicalism. *Actual-plus-Ghost* is a physical duplicate of the actual world but not a complete duplicate.

Physicalism is a claim about the metaphysical structure of the actual world. It claims that dualism is false, but not that dualism is metaphysically impossible. Physicalists believe Descartes was wrong about the existence of mental substances. But they need not think that Descartes imagined a metaphysical impossibility. Some world might be the way Descartes thought the actual world to be. The possibility of worlds at which dualism is true, such as *Actual-plus-Ghost*, does not challenge the physicalism that modal physicalists sought to capture. As Jackson (1993, 161) writes, 'It is perfectly consistent with physicalism that there be a possible world exactly like ours which contains *as an addition* lots of mental life sustained in non-material stuff'. (Stronger forms of physicalism might deny such possibilities).

While the implications of modal physicalism about the actual world do not reach as far as *Actual-plus-Ghost*, they do reach other regions of modal space. For example, modal physicalism is incompatible with the metaphysical possibility of zombie worlds. A *zombie world* is a physical duplicate of the actual world that lacks all conscious experiences. Zombie worlds contains zombie doppelgangers who stroll the waterfront saying, 'I can smell the ocean'. But they do not have conscious experiences of smelling salt. The possibility of zombie worlds entails that the actual physicalia are modally insufficient to yield consciousness. If such worlds are possible, physicalism is, in some important sense, false. At the least, such thinking motivates much of the ink spilled finessing the nuances of formulating physicalism modally.

We want a modal formulation of physicalism that makes commitments about the structure of modal space. It should rule out the possibility of zombie worlds and inverted qualia worlds (physical duplicates in which red and blue experiences are swapped). But it should not rule out the

## REGIONS AND LOCATIONS IN MODAL SPACE



**Figure 1.** The inner-most region (green) is the target containing the worlds relevant to the truth of physicalism. The middle region (red) contains the physical duplicates of the actual world. The outer-most region (black) contains all the possible worlds.

possibility of *Actual-plus-Ghost* or a world of pure ectoplasm. The problem of extras is the problem of characterizing exactly the portion of modal space that physicalism entails are duplicates *simpliciter* of the actual world (Figure 1). The problem with simple modal physicalism is that it does not capture this target region. There are physical duplicate worlds outside the target zone.

Intuitively, the zombie world and the inverted qualia world are physical duplicates that contain ‘no extras’, while *Actual-plus-ghost* and a pure ectoplasm world do contain ‘extras’. The strategy that has been adopted, in one form or another by a wide variety of authors, including Chalmers (1996), Leuenberger (2008), Lewis (1983), and Jackson (1993), is to claim that the relevant portion of modal space contains exactly the physical duplicates of the actual world that do not contain any extras. Each author has their preferred method for spelling out the ‘no extras’ clause. The following sections argue that each definition, in order to capture the target region of modal space, implicitly relies on the notion of fundamentality.

### 3.1.2. Alien physicalism (Lewis)

Lewis (1983) defines physicalism as follows.

*Alien Physicalism (AP)*: Among worlds where no natural properties alien to our world are instantiated, no two differ without differing physically; any two such worlds that are exactly alike physically are duplicates.

An *alien* property is a property not instantiated at the actual world. Lewis's definition limits the commitments of Alien Physicalism to the target region of modal space via the restriction to non-alien worlds. Worlds like *Actual-plus-Ghost* and the Ectoplasm world contain alien properties. Thus, they fall outside the scope of Alien Physicalism's commitments.

The notion of a *natural* property plays a variety of roles in Lewis's metaphysical system. Natural properties cut at nature's joint, figure in laws of nature, function as reference magnets, and, lastly and most importantly, are metaphysically fundamental. I'll argue that other authors implicitly rely on fundamentality. But Lewis's appeal to fundamentality is explicit (Lewis 1995, 413). Lewis's definition is complicated by the fact the notion of a natural property is not exclusively the notion of a fundamental property in my sense.

### 3.1.3. *Minimal duplicate physicalism (Jackson)*

Jackson (1993) defines physicalism using the notion of a minimal physical duplicate.

*Minimal Duplicate Physicalism (MDP)*: Any world which is a minimal physical duplicate of our world is a duplicate simpliciter of our world. (28)

Two features of Minimal Duplicate Physicalism require clarification. The first is the notion of a *physical* duplicate. The second is the notion of a *minimal* duplicate. What does it take for a world to count as a *physical* duplicate of the actual world? Physicalists, Jackson included, think that, in some sense or other, everything is physical, including mental states. But surely Jackson cannot have meant to include mental states among the physicals that must appear at every physical duplicate of the actual world. That would prejudice the issue against the dualist and trivialize the definition. Modal physicalism says that copying all the physical stuff, in some restricted sense of 'physical', is sufficient to copy all the other stuff, including the mental (in the absence of extras). If we start by the counting all 'the other stuff' as physical, the issue of physicalism vs. dualism is decided from the start. It's clear enough what Jackson intends. If we copy all the actual world's electrons, leptons, bosons, molecules, masses, charges, spins, physical laws, and the like, we create a

physical duplicate of the actual world. Let's call the material that must be duplicated in order to yield a physical duplicate of the actual world *strictly physical*. The physical duplicates of the actual world are the strictly physical duplicates.

We must also clarify the notion of a *minimal* duplicate. The basic idea is clear. The minimal duplicates of the actual world are those that contain all the same stuff, and do not add any extras. Getting more precise, minimal duplicate physicalism presupposes a partial ordering  $\leq$  among the physical duplicates of the actual world.  $\leq$  must be reflexive, antisymmetric, and transitive. The minimal physical duplicates of the actual world will be those that are (a) physical duplicates and (b) minimal with respect to  $\leq$ . (A world  $w$  is *minimal with respect to*  $\leq$  iff there is no world  $v$  such that  $v \leq w$ .)

All this talk about minimal and complete duplicates sounds more complicated than it is. Let us assume, plausibly, that there are no two distinct possible worlds that are complete clones. If MDP is true, then there is one and only one minimal physical duplicate of the actual world: the actual world itself. If MDP is false, there is either more than one such duplicate, or there is a physical duplicate that is *more* minimal than the actual world. How might each of these occur? First, a zombie world – a physical duplicate of the actual world with no experiences whatsoever – would be a physical duplicate of the actual world that is more minimal than the actual world. Thus all the minimal physical duplicates of the actual world (i.e. the zombie world) would not be complete duplicates. Second, suppose that zombie worlds are impossible, but inverted qualia worlds are. An *inverted qualia world* is a physical duplicate of the actual world in which the experiences are switched around. When you experience blue, your inverted twin experiences red. When you experience a pain your twin experiences a tickle. In such a situation, there would be multiple minimal physical duplicates of the actual world (all the various inverted worlds, including the actual world), but they would not all be complete duplicates of the actual world.

Unfortunately, Jackson does not say much about how the ordering  $\leq$  should be established. His explanation simply stops. He does, however make some suggestive comments that help us figure out what he had in mind. Though he does not say so explicitly, I claim that this is what he had in mind:  $w \leq v$  iff  $v$  contains all the fundamentalia of  $w$ . Alternatively,  $w \leq v$  iff all the fundamental facts of  $w$  are also fundamental facts of  $v$ . Two pieces of evidence point toward this interpretation. First, when Jackson explains the idea of minimal duplicate physicalism, he writes that

A minimal physical duplicate of our world is what you would get if you – or God, as it is sometimes put – used the physical nature of our world (including of course its physical laws) as a recipe in this sense for making a world.

Two points are worth making about this passage. First, Jackson brings up the metaphor of God creating the world. This is the creation test that I discussed in Section 1.1, which is a heuristic for gauging fundamentality. Second, Jackson's discussion of a recipe for creating the world smacks of fundamentality. The basic ingredients of a world are its building blocks: the *fundamentalia*. A recipe for world creation is a description of the world's fundamental layout. Finally, on page 36, Jackson explicitly writes about 'the properties and relations viewed as the fundamental ingredients of everything'.

If we interpret  $\leq$  using the notion of fundamentality, then minimal duplicate physicalism targets the correct region of modal space. MDP is compatible with the metaphysical possibility of *Actual-plus-Ghost* because *Actual-plus-Ghost* contains *fundamentalia* that the actual world does not (e.g. the ghostons of which Casper is made), and is thus not a minimal physical duplicate of the actual world.

### 3.1.4. Proper part physicalism (Chalmers)

Chalmers (1996) copes with the problem of extras in his modal formulation of physicalism by utilizing the notion of a *positive fact*, which is defined in terms of a relation of parthood between possible worlds.

*Positive Fact Physicalism (PFP)*: All positive facts about the actual world are necessitated by the physical facts.

A fact  $P$  *necessitates* a fact  $Q$  iff  $Q$  is true at all the possible worlds where  $P$  is true. Chalmers defines the notion of a positive fact in terms of a relation of parthood on possible worlds. 'We can define a positive fact in  $W$  as one that holds in every world that contains  $W$  as a proper part' (40). Intuitively, negative facts include negative existentials ('There are no ghosts'), as well as universally quantified statements ('All living creatures contain carbon'). Positive facts include every day facts like 'David Chalmers is a philosopher', 'Australians tend to ridicule Canberra', and 'Beirut is 5500 kilometers from Paris'.

Troubles arise when we consider what it is for one world to contain another as a proper part.  $W+$  can contain  $W$  even though 'there are no ghosts' is a fact (and perhaps a part?) of  $W$  but not of  $W+$ , and despite

the fact that I am tall at  $W$  but not at  $W+$  (because the extra inhabitants of  $W+$  are numerous and larger than those of  $W$ ). Further difficulties arise when we consider the possibility that some intuitively positive facts (I am having a red experience, Goliath is a statue) could be *blocked* by the addition of extras. Leuenberger (2008) imagines a world  $@+$  that contains the actual world  $@$  as a proper part.  $@+$  contains an additional non-physical substance, Algoplasm, in the region of my skull. In the actual world the neural configuration of my brain gives rise to red experiences. But the presence of Algoplasm in the region of my skull at world  $@+$  suppresses those red experiences. If such a scenario is possible, then it will turn out that the fact that I have a red experience is not a positive fact of the actual world. It is not true at every world that contains the actual world as a proper part. That would be a disaster for the Chalmers positive fact formulation. If my having a red experience is not a positive fact, then the relation between the physical and that experience is irrelevant to the truth of physicalism, in the same way that the relation between the actual physical stuff and the presence or absence of ghostly Casper is irrelevant. But the relation between the physical and my red experiences is precisely what is at stake in many debates over physicalism.

Accepting that my having a red experience is a negative fact is not an option for Chalmers. He will be forced to either deny that such blocking situations can occur, or deny that the world containing Algoplasm contains the actual world as a proper part. The first option might seem palatable. The cost of denying the possibility of far out metaphysical scenarios like experience-blocking Algoplasm seems low. But the blocking of intuitively positive facts can occur in much more mundane situations. Consider a cube carved from a block of wood. The fact that the world contains a wooden cube seems like a positive fact. But now imagine exactly that same configuration of cubical wood inside a tree. The fact that that the world contains a wooden cube has been blocked.<sup>8,9</sup>

The remaining option is to deny that the world  $@+$  containing Algoplasm contains the actual world as a proper part. This is a live option

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<sup>8</sup>*Objection:* This type of blocking can't occur when one world contains another as a proper part. If the wooden cube is present at world  $w$ , then the empty space around  $w$  is present. Any world that contains  $w$  as a proper part will contain both the cubical wood and the empty space around it, which is sufficient to guarantee the presence of the wooden cube. *Reply:* It's false that any world containing the wooden cube will contain the empty space. First, we can place the wooden cube at the edge of a world with finite space. Second, if we insist that the empty space of  $w$  be present at any world that contains  $w$  as a proper part, we make 'this space is empty' a positive fact. But that's a paradigm of a negative fact. So we should not insist that any world that contains  $w$  as a proper part contains the same empty space as  $w$ .

<sup>9</sup>Leuenberger (2008) has a similar case involving a stone statue of David.



for Chalmers. In this setup, the notion of parthood among worlds is taken as basic, and the positive/negative fact distinction is defined in terms of it. The problem here is that if we take the notion of parthood as basic while denying that @ is a part of @+, we lose our grip on the relevant notion of parthood. If we add some Algoplasm to the actual world, we get @+. Thus, under the ordinary mereological notion of part/whole, @ is a part of @+. Taking parthood as our primitive only works if we have some grip on that notion. But now we realize that Chalmers will be forced to use some other notion of parthood, parthood\*, which seems somewhat stipulatively defined to get the results he needs. Positive fact physicalism, defined in terms of Chalmers-style-parthood\* on worlds, loses its power as an interesting formulation of physicalism.

The basic problem with positive fact physicalism is that, because positive facts can be blocked by the addition of extras, it's simply false that the physical facts, fundamental or not, necessitate all the positive facts, at least in the intuitive sense of 'positive' (Leuenberger 2014; Skiles 2015).<sup>10</sup> One could utilize the notion of fundamentality to define a relation of parthood on worlds:  $w$  is a part of  $v$  iff all the fundamental facts of  $w$  are fundamental facts of  $v$ . But this runs into the same problem: those fundamental facts will not necessitate all facts, precisely because of the possibility of blockers. Alternatively, one could abandon the notion of positive facts and use parthood, defined using fundamentality, to explicate the ordering  $\leq$  utilized by Jackson in the previous section.  $w \leq v$  iff  $w$  is a part of  $v$ . The resulting view will be equivalent to the final, and best, version of Jackson's minimal duplicate physicalism, in which minimality is defined in terms of fundamentality.

### 3.1.5. *Ceteris absentibus physicalism (Leuenberger)*

Leuenberger (2008) defines physicalism using the notion of *ceteris absentibus sufficiency*.

*Ceteris Absentibus Physicalism (CAP)*: The actual physical facts are *ceteris absentibus* sufficient for all actual facts.

An example will help illustrate the concept of *ceteris absentibus* sufficiency. If I blend the proper proportions of crushed garlic, chili, lime, and fish

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<sup>10</sup>For a nice discussion of types of blocking, and which types should and should not count against physicalism, cf. Chilovi (2018).

sauce, that is sufficient for a delicious spicy Thai sauce. But those ingredients do not guarantee deliciousness without fail. If you add three tablespoons of veggiemite when I look away, my sauce will transform from delectable to detestable. The garlic, chili, and the like are, *ceteris absentibus*, viz. other things being absent, sufficient for a delicious sauce. But if *ceteris* is not *absentibus*, veggiemite can block the fact that the sauce is delicious.

*Ceteris absentibus* sufficiency is a modal notion. *Ceteris absentibus* physicalism says that, at all the worlds at which the actual physical facts are true, and other things are absent, all the actual facts are true. CAP seeks to hit the target zone of modal space by the *ceteris absentibus* clause. At worlds like *Actual-plus-ghost*, *ceteris* is not *absentibus*. In addition to the physical, that world contains extras, including Casper. Or, at least, that's the idea.

Trouble arises when we look closer at the notion of *ceteris absentibus*: 'other things being absent'. *What* other things? A first-pass answer is, 'Things other than the physical'. But that can't be right. Mental phenomena do not count as physical in this context. (Though they may be grounded in or necessitated by physicalia, and the actual physical facts may be sufficient for the presence of mental phenomena). If they did count as physical, then the dualist could accept *ceteris absentibus* physicalism, and the thesis would be robbed of its interest as an implementation of physicalism. But if mental phenomena do not count as physical, then they must be counted among the 'things other than the physical' excluded by the *ceteris absentibus* clause. The result is that *ceteris absentibus* physicalism says that the actual physical facts, other things – including all mental facts – being absent, are sufficient for all the actual facts. But this is patently false. Mental facts are among the actual facts. The *ceteris absentibus* physical facts can't be sufficient for the mental facts if the '*ceteris absentibus*' clause excludes the mental facts. I take this as a *reductio* of the suggested implementation of '*ceteris absentibus*' as 'things other than the physical being absent'.

Leueberger did not intend to exclude mental phenomena with the *ceteris absentibus* clause. But he did intend to exclude the ghostons out of which Casper is composed. (*N.B.*: *ghostons* are ghost particles). What's the difference between the two? I will argue that what Leueberger has in mind, and really the only way to differentiate what the *ceteris absentibus* clause excludes and does not, uses the notion of *fundamentality*. The physical facts are, other *fundamentals* being absent, sufficient for all actual facts.

Before we go on to explicate *ceteris absentibus* using the notion of fundamentality, let us look at why other attempts will not work. First, one might claim that the difference between the mental phenomena that are not excluded by *ceteris absentibus* and ghostons that are is that the former are necessitated by the physical while the latter are not. This will not work for Leuenberger. First, Leuenberger is looking for a formulation of physicalism that utilizes *ceteris absentibus* sufficiency in lieu of necessitation. Second, because he believes that many facts, including mental facts, can be blocked by the addition of extras, Leuenberger (2008) explicitly denies that the physical facts necessitate the mental facts. (He doubles down on this claim in Leuenberger 2014). He believes that, *ceteris absentibus*, the physical gives rise to the mental, but that certain alien properties (e.g. Algoplasm) can block the mental from arising from the physical, in a manner similar to the way your vegemite blocks my sauce from being delicious. The possibility of such blockers is a vital ingredient in Leuenberger's use of *ceteris absentibus* physicalism to reply to the zombie argument (Leuenberger 2008, Section 4). Necessitation from the physical can't be the relevant difference between the mental and Casper's ghostons.

Further problems arise when we consider the possibility that the ghostons out of which Casper is generated are themselves mental. Then it will turn out that some mental phenomena (your experience of pain) are not excluded by the *ceteris absentibus* clause, while other mental phenomena are excluded (Casper's ghostons). A similar point applies to any type of phenomena (temperature, atoms, nations) that is generated from the physical at the actual world, but might have been generated from some other type of fundamentalia, or itself have been fundamental (e.g. atoms).

Once we avail ourselves of the ideology of fundamentality, the difference between the mental phenomena that are not excluded by the *ceteris absentibus* clause (such as our pains and representations) and those that are (Casper's ghostons), is easily spelled out: the latter are fundamental. '*Ceteris absentibus*' says, 'other things being absent'. We are seeking an answer to the question, 'What other things?'. The answer is, 'other fundamentalia'. Actual-plus-ghost, which contains Casper, has fundamentalia that go beyond the actual physical fundamentalia. All the worlds outside the region of modal space that modal physicalism aims to target contain extra non-physical fundamentalia.

The moral of the story is that the best way to explicate the notion of *ceteris absentibus* is to use the notion of fundamentality. 'Other things being absent' means 'other *fundamentals* being absent'. (Leuenberger (p.c.) has told me that this is, basically, what he had in mind.)

### 3.1.6. *Drawing from the conceptual wellspring of physicalism*

I should be clear about the criticism I am leveling of these modal formulations of physicalism. I am not claiming that Alien, Minimal Duplicate, Proper Part, and *Ceteris Absentibus* Physicalism cannot, no matter what the cost, solve the problem of extras without making recourse to the notion of fundamentality. Any formulation of physicalism must take some notion as primitive. Jackson *could* take the notion of minimal physical duplicate as primitive, and refuse to define or explain the idea of a 'minimal duplicate'. Chalmers could do the same with the notion of a proper part of a world, and Leueberger likewise with *ceteris absentibus* sufficiency. But once they do, we should always ask what exactly they mean by 'minimal duplicate' or '*ceteris absentibus* sufficient'. At that stage, they can either remain silent or make recourse to the notion of fundamentality.

I am saying that fundamentality provides a particularly good way to precisify the key notion in each of the proposed definitions. When theorizing, it matters which notions we take as basic. The primitive notions of a theory should reflect the conceptual foundations of the area of inquiry. The fact that fundamentality has been either implicitly relied on when formulating these modal physicalisms or provides a good way to clarify those theses is strong evidence that the notion of fundamentality is conceptually fundamental in this domain. Fundamentality is a better and more natural primitive to use when formulating physicalism. Finally, if the above authors refuse to precisify using fundamentality, and instead take their favored notion as primitive, I hypothesize that our grip on that primitive notion derives from an antecedent grip on the idea of fundamentality.

Lastly, I will argue shortly (Section 3.3) that what Lewis, Jackson, Chalmers, and Leuenberger really had in mind, when formulating a modal version of physicalism, was fundamentality physicalism. If this is correct, then it should come as no surprise that the notion of fundamentality either implicitly appears in those other areas and/or can be used to further clarify and explain them. The problem of extras, which these philosophers sought valiantly to solve, is really the problem of extra *fundamentals*.

## 3.2. *When modal physicalism yields the wrong verdict*

The root problem with modal physicalism is that it guarantees only modal covariation between the physical and everything else. Mere covariation is not strong enough. Physicalism requires *dependence* of the mental on the

physical.<sup>11,12</sup> Because covariation is easier to achieve than dependence, there are scenarios in which modal physicalism yields the wrong verdict. It tell us that modal physicalism is true, but physicalism is clearly false. I shall discuss two types of trouble cases here, which I will call *the problem of necessary existents* and *the problem of downward necessitation*.

The problem of necessary existents is well known. Here is one version. Suppose that there is a necessarily existing non-physical God. He will exist at every minimal physical duplicate of the actual world, and at every non-alien world. The physical will be *ceteris absentibus* sufficient for his existence, and his existence will be a positive fact that holds at every physical duplicate of the actual world. Thus the necessary existence of a non-physical God is perfectly compatible with modal physicalism. But, clearly, the existence of a non-physical God is barred by physicalism. Modal physicalism gets this case wrong.

The problem of downward necessitation is, to my knowledge, not discussed elsewhere. Russell (1927) imagined a situation in which the basic physical properties had underlying categorical bases. Deeper properties or entities make the electrons, bosons, and leptons have the charges and masses they do. Suppose that the underlying basis of the electron is a consciousness particle: a miniature experience. Assume also that, necessarily, the state of the consciousness particles necessitates the state of the electrons and vice versa. Each necessitates the other. Otherwise the fundamental level is purely physical. Under these assumptions, modal physicalism is true. Any world with the same physical state as the actual world will have the same electron state, which guarantees the same state of the consciousness particles. But in such a situation physicalism is clearly false. Physicalism, however one conceives it, is incompatible with consciousness particles in the bedrock of reality. The problem here originates in the 'downward' necessitation from the electrons to the underlying consciousness particles. The necessitation is 'downward' to the 'underlying' consciousness particles because, in the envisaged scenario, the particles are *more fundamental* than the electrons. That is also why physicalism is intuitively false in such a scenario. Downward necessitation allows the less fundamental (in this case the electrons) to necessitate the more fundamental, which enables intuitively non-physicalist scenarios with fundamental consciousness particles to pass modal physicalism's test for physicalist respectability.

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<sup>11</sup>Modal covariation could be said to mark a type of modal 'dependence'. I claim that physicalism requires something stronger than the mere modal covarational form of 'dependence'.

<sup>12</sup>A similar criticism appears in Wilson (2005).

### **3.3. Fundamentality physicalism and modal physicalism**

Modal physicalism's miscategorization of the necessarily existing God case and the consciousness particle case points the way to a better definition of physicalism: fundamentality physicalism. What modal physicalism lacks is a dependence of the mental on the physical. In fact, I think that much of modal physicalism's plausibility derives from its affinity to fundamentality physicalism. Modal physicalism is as close as you can get to fundamentality physicalism without mentioning the words 'fundamentality', 'dependence', or 'ground'.

I would like to make three points in support of the claim that modal physicalism derives its plausibility from fundamentality physicalism. First, other major modal formulations turn out to implicitly rely on, or at least are best implemented using, the notion of fundamentality. This was recently discussed at length in Section 3.1. Second, fundamentality physicalism entails modal physicalism. Third, what many who offered modal formulations of physicalism had in mind was fundamentality physicalism.

Fundamentality physicalism entails modal physicalism. Modal physicalism says that all the physical duplicates 'without extras' are complete duplicates. I have argued that the correct way to cash out the idea of 'extras' is via the notion of extra fundamentalia. If all the actual fundamentalia are physical, as fundamentality physicalism claims, then every physical duplicate world will contain all the fundamentalia that the actual world contains. Every physical duplicate world 'with no extras' will contain all and only the same fundamentalia as the actual world. By the modal covering constraint (p 5), no two worlds differ without differing in their fundamentalia. I.e. any two worlds that are fundamental duplicates are complete duplicates. Combining all these claims, fundamentality physicalism entails that all physical duplicates without extras are complete duplicates, which is exactly the definition of modal physicalism.

Because modal physicalism is a necessary condition for fundamentality physicalism, an argument against fundamentality physicalism will succeed if it can falsify modal physicalism. Much of the contemporary attention to physicalism has consisted in arguments against physicalism and defenses against those arguments. For these purposes, operationalizing physicalism via modal physicalism makes sense. Modal physicalism has some advantages, in particular its reliance on the familiar idea of metaphysical modality. But, we should not, after decades of operationalization, confuse the operationalized conception with the real thing: fundamentality physicalism.

Many who offered modal formulations of physicalism really had fundamentality physicalism in mind. Two pieces of evidence support this claim. First, modal formulations are typically motivated using the metaphor of God constructing the world. This type of reasoning appears in Leuenberger (2008, 1), Jackson (1993), and Chalmers (1996, 38–41). But the metaphor of a world-making God is exactly the creation test for fundamentality from Section 1.1. Second, when philosophers discuss cases in which modal physicalism is falsified, without fail they discuss cases in which there are non-physical fundamentalia. Both of Chalmers (1996)'s hypotheses for the failure of modal physicalism involve extra fundamentalia: psycho-physical natural laws and a layer of non-physical entities underlying microphysics.

All of these considerations point toward the conclusion that modal physicalism, and philosopher's use of modal physicalism, is really just an attempt to get at the real McCoy: fundamentality physicalism. I do not take this point to be that original. Others have made it recently, though they tend to use the lexicon of 'ground'. For example, Schaffer (2003, 2009, [forthcoming](#)) writes that ground is *the* notion needed to define physicalism. Kim (1982) writes that modal covariation might be explained by a relation of metaphysical dependence:

Supervenience itself is not an explanatory relation. It is not a 'deep' metaphysical relation; rather, it is a 'surface' relation that reports a pattern of property covariation, suggesting the presence of an interesting dependency relation that might explain it (Kim 1982, 167).<sup>13</sup>

Modal physicalism is a claim about a certain type of supervenience on the physical. It is unsurprising that philosophers would reach for modal tools when attempting to characterize fundamentality physicalism. Modality is a familiar notion with a well-understood formal framework. Fundamentality, metaphysical dependence, and ground are not. (Though that is changing). Lewis (1983, 29) lauds supervenience as 'a stripped-down form of reductionism, unencumbered by dubious denials of existence, claims of ontological priority, or claims of translatability'. Modal formulations of physicalism do have some advantages. First, when arguing against physicalism, it suffices to argue against a necessary condition for physicalism. Modal physicalism provides such a condition. If Chalmers (1996)'s arguments against modal physicalism work, then he has established the falsity of fundamentality physicalism. It makes sense for

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<sup>13</sup>For a dissenting view, according to which supervenience is explanatory, cf. Kovacs ([forthcoming](#)).

Chalmers to opt for a more easily understood and less controversial target that uses the familiar language of modality rather than the less reputable notions of fundamentality or dependence that Lewis disparaged. Second, unlike fundamentality-oriented conceptions, modal formulations completely avoid the biggest problem for fundamentality definitions: 'The Problem of Abstracta', which will occupy our attention for the remainder of this paper. As Lewis points out, modal formulations are less committal because they do not entail any dependence of the mental on the physical. Unfortunately, this lack of commitment means that modal definitions can fail to capture the intuitive conception of physicalism at which they aimed.

## 4. The problem of abstracta

### 4.1. The problem

Formulating physicalism in terms of fundamentality rather than modality might seem to constitute unadulterated progress. But new technologies introduce new problems. Fundamentality physicalism faces *the problem of abstracta*. There are many facts, in particular facts about abstract objects like universals and numbers, that do not appear to be generated from the physical. Modal formulations do not face the problem of abstracta. Facts about abstracta are, in all likelihood, necessary. If so, they are necessitated by anything. Modal formulations get the facts about abstracta 'for free', and thus can ignore the issues I shall now discuss.

If fundamentality physicalism, as formulated thus far, is true, mathematics must be either physical and fundamental or dependent upon physical fundamentalia. Both options are implausible. Consider the mathematical fact that three is prime. If three's primeness is grounded in quarks and leptons, it is grounded in a vastly different manner than my desk. We can alter my desk by modifying the underlying fundamentalia. But no amount of rearrangement will alter the primeness of three. This is evidence that the number three does not depend on physical fundamentalia. In fact, given that the number 3 has its mathematical properties necessarily, it appears to be completely modally independent of the physical. Of course, modal tests for dependence are defeasible. But they tell against the dependence of the mathematical on the physical. The best candidate for the metaphysical grounds of three's primeness are the axioms of arithmetic. But physical fundamentalia fare no better in grounding these axioms than they did with three's primeness.



The simplest solution to the problem of abstracta is either eliminativism, according to which there are no mathematical facts or phenomena to be accounted for, or some version of *ground nominalism*, according to which mathematical facts are grounded in concreta, perhaps facts about mental states. Eliminativism is too radical for my tastes, and I have already argued against ground nominalism.

The remaining option is that mathematical facts are fundamental. Does this challenge fundamentality physicalism? This depends on whether fundamental mathematics should count as 'physical'. I wish to make two points against mathematical fundamentalia counting as 'physical'. First, fundamental mathematics would be quite different from the clearly physical quarks, leptons, and bosons, or masses, charges, and spins. It is also different from fundamental physical laws. Second, counting fundamental mathematics as physical has an odd result. Since mathematics is necessary, every possible world will contain physical fundamentalia.

Consider the possible world *Casper* whose fundamental level is purely spirit substance. Arrangements of spirit substance ground the ghosts, ghouls, angels, and demons that inhabit *Casper*. *Casper* appears to contain no physical stuff whatsoever. But the truths of mathematics also hold at this world, and any theorist of *Casper's* fundamental level will need to say something about the mathematical. Suppose, as just stated, that the mathematical is fundamental. If we declare the mathematical fundamentalia of the actual world to be physical, then it will turn out that *Casper*, an apparently purely spiritual world, contains physical elements at the fundamental level. This is an odd result. Furthermore, the same line of reasoning that led to declaring fundamental mathematics 'physical' can be run at *Casper*. The spirit philosophers of *Casper* have just as much reason to categorize the mathematical as 'spiritual'. If they are correct, then the actual world contains fundamental spiritual elements! Perhaps these mathematical fundamentalia are both physical and spiritual? I'm not sure what to say.

#### **4.2. In search of neutrality**

One might reply to the problem of grounding mathematics in the physical by abandoning physicalism (2017). Or one might search for a conception of physicalism that is compatible with the failure of the physical to ground mathematics. The remainder of this paper pursues the latter route. However, I should admit that this is a retreat position. A theory that grounded mathematics in the physical would be a stronger and more

ambitious physicalism. But I am not concerned with finding the strongest version of physicalism. Instead, I search for a physicalism that is both strong enough to remain interesting and has a shot at being true.

If the mathematical is fundamental, it is fundamental at every world. I think that the best thing to say about mathematical fundamentalism is that they are, in a certain sense, neutral in relation to debates over fundamentality physicalism, spiritualism, deism, or dualism. Schiffer (1989) and Stoljar (1996) agree with this verdict. Any theory of the fundamental will face the same problem. The spiritualist and the dualist are no better situated than the physicalist when it comes to tackling the place of mathematics (or of universals).

There are several ways to achieve the neutrality of mathematics, universals, and other domains that fall under the problem of abstracta. The notion of fundamentality at play is closely linked to the notion of ground. There are three ways of excluding the mathematical: (i) restrict that which is grounded (ii) restrict that which grounds or (iii) restrict the relation (ground). Some versions of (iii) will entail (i) or (ii). But not all. Each strategy comes in two flavors: restriction by fiat and restriction by principle. The second flavor is to be preferred. Better to have a principled reason for excluding the troublesome abstracta. Such a reason provides a defense against the accusation that one is guilty of special pleading (on behalf of, e.g. physicalism).

Restriction by fiat is not as bad as it might seem. From a historical perspective, it is quite clear that issues about mathematics and universals have been set aside in these debates over fundamentality (Schiffer 1989; Stoljar 1996). Modal formulations set them aside very nicely, as a corollary of operating modally. But perhaps the proponent of a fundamentality conception can just as easily put them aside. The opposition, however, will claim that we are simply repeating the sins of our ancestors.

I offer three independent solutions to the problem of abstracta: the 'inapt for ground' solution, the concrete restriction, and the contingency restriction. All three involve restrictions in the scope of the ultimate grounds to whose physical nature fundamentality physicalism is committed. Before going into those solutions, let me lay out why a restriction in the grounded is unlikely to succeed. Suppose we stipulated that fundamentality physicalism requires only that the fundamentalism which ground, say, concrete, facts are physical (more on this strategy soon). This is compatible with non-physical mathematical fundamentalism, as long as they ground only other mathematical facts. But it is not compatible with non-physical mathematical fundamentalism that ground, at least

partly, physical facts. And, unfortunately for the suggested view, it is plausible that this type of grounding does occur. Suppose you have 10 cookies to distribute to the children in the room. There are 4. Consider the fact that the cookies cannot be evenly distributed to the children in the room; there is no way to give out all 10 cookies so that each child receives the same number of cookies. This fact is concrete. But it is partly grounded by the mathematical fact that ten is not divisible by 4. The lesson is that mathematical facts play a role in grounding the concrete facts. Thus, a restriction amongst the grounded will not sidestep the determinative role of mathematics.

### 4.3. *The inapt for ground solution*

My preferred solution to the problem of abstracta is a modification, or expansion, of a solution offered by Dasgupta (2015) to a particular version of the problem of abstracta. Initially, Dasgupta defines physicalism as the claim that all the ungrounded facts are physical facts. But he is worried about a challenge from the facts about grounding (cf. also Sider 2012). If physical fact  $P$  grounds mental fact  $M$ , then there is a further fact: the fact that  $P$  grounds  $M$ . What grounds this fact?<sup>14</sup> If there is no physical ground, then physicalism is falsified. The problem of ground is one version of the problem of abstracta.<sup>15</sup> Bennett (2011) and deRosset (2013) argue for the *super-internality solution*, according to which the ground of [ $P$  grounds  $M$ ] is  $P$  itself. Dasgupta rejects this approach. His primary reason is that the ground, or explanation, of  $P$  grounds  $M$  must surely involve  $M$  in some way.  $P$  makes  $M$  the case partly in virtue of  $M$ . A more concrete example: it is partly in virtue of the nature of pain that Jemele's  $c$ -fiber firings ground her pain.

Dasgupta's solution is to divide the ungrounded into two categories: the substantive and the autonomous. Substantive facts are apt for being grounded; autonomous facts are not. Physicalism, as Dasgupta construes it, requires only that the ungrounded substantive facts be physical. Autonomous facts may be non-physical. And, importantly, according to Dasgupta, the allegedly troublesome grounds of the facts about ground are autonomous.

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<sup>14</sup>The threat here is not that of infinite regress. Cf. Rabin and Rabern (2016, 3.4). The worry is that facts about grounding relations are not themselves physically grounded.

<sup>15</sup>The problem of abstracta' is not an ideal name. Grounding facts can involve concreta just as much as koala facts do. But 'the problem of stuff that is problematic for fundamentality (/ground/dependence) physicalism' sounds even worse.

Dasgupta's division leads to three categories: (i) the autonomous facts, which are not apt for ground, (ii) the grounded substantive facts, which are both apt for ground and grounded, and (iii) the ungrounded substantive facts, which are apt for ground but have none. These last are the fundametalia as we have conceived them. Dasgupta explains the categories via an analogy with causal explanation, which admits of a similar tripartite division.

We recognize three categories. First, there are facts that are apt for causal explanation and have one, for example, facts about the current physical state of the Empire State Building. Second, there are facts that are apt for causal explanation but lack one, for example, facts about the initial physical state of the universe. And third, there are facts that are not apt for causal explanation in the first place, for example, facts of pure arithmetic. (576)

In the case of ground, what types of facts are autonomous? Facts about the natures, or essences, of things, construed as something like Aristotelian *real definitions*, make good candidates. A *real definition* of *x* describes what it is to be *x*. Dictionary definitions might be real definitions, but they need not be. The meaning of a word need not reveal the metaphysical nature of its referent. Being married is at least part of the nature, or essence, of being a husband. (I use 'essence' and 'nature' interchangeably.) Consider the fact that husbands are married. Now ask, 'Why are husbands married?' This fact is autonomous because the fact that husbands are married is part of the nature of husbands (or of husband-hood).<sup>16</sup> Being married is just (part of) what it is to be a husband. Importantly, we are not searching for some as yet undiscovered explanation for why husbands are married. Instead, the search is inappropriate. Contrast the fact that husbands are married with the fact that the speed of light is 671 million miles per hour. Neither fact has an explanation; neither is grounded. But the fact about light's speed is apt for explanation. Scientists can legitimately inquire after its grounds.

There are some explanations one can give for either fact. One can ask why we believe that husbands are married. We can ask why the word 'husband' refers to things all of which are married. Those are legitimate questions, but they are not germane. We are asking about the distinctively metaphysical grounds of the fact that husbands are married.

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<sup>16</sup>Rather than taking 'Husbands are married' as autonomous, some might prefer to take 'Husbands are married' as grounded in a separate fact like 'It is in the nature of husband-hood that husbands are married', which is itself autonomous. I do not intend to adjudicate this infight between fans of autonomy here, nor to weigh in on exactly which fact in the neighborhood is autonomous. Thanks are due here to an anonymous referee.

Epistemological and semantic explanations are not relevant. Similar points apply to explanations for the speed of light.

For some, the foregoing comments about autonomous facts will be sufficient. But others may feel uncomfortable resting their metaphysics on talk of facts that 'don't need explanation' or on a distinction between 'appropriate' and 'inappropriate' why?-questions. Such anthropocentric distinctions can seem out of place in the metaphysics room. A potential precisification of the substantive/autonomous distinction, *substantivity as possible grounding*, is worth discussing. Autonomous facts are ungrounded. They are likely to be necessarily so. 'Being unfit for ground' does not seem like the type of property that changes from world to world. We have already said that a substantive fact is 'apt for ground'. Some substantive facts – the fundamental facts – don't have actual grounds. But we could maintain that they might have been grounded. The state of the quantum wave-function is a good candidate for a substantive ungrounded fact. Some string theorists maintain that the state of the wave-function is grounded in the properties of strings. Suppose these theorists are wrong. The state of the wave-function, and not string-fluctuations, is fundamental. But if we accept that the string theorists might have been correct, then there is some other world at which the wave-function is grounded. If we accept an analogous view about all substantive fundamental facts, the result is an account according to which the substantive facts are all and only the facts that are possibly grounded. This account commits one to *the contingent fundamentality thesis*: all substantive fundamental facts are only contingently fundamental. This is not an implausible view, but accepting it is clearly an additional philosophical commitment. This cost might be outweighed by an attractive feature of the substantivity as possible grounding account: it reduces substantivity – a new and somewhat vexed concept – to the familiar notions of ground and possibility. I am sympathetic to substantivity as possible grounding, but will not assume the view in the forthcoming discussions. But I hope it will quiet the stomachs of those who are otherwise queasy about the substantive-autonomous distinction.

With the substantive-autonomous distinction in tow, let us return to the problem of abstracta, in particular mathematics. My solution comes in two parts. First is the *restriction to the substantive*: the fundamental facts are the ungrounded substantive facts. Second is *mathematical autonomism*: mathematical facts are fully grounded in autonomous facts. In the mathematical realm, there is a bottom ungrounded level, but it is purely autonomous. And thus it does not challenge physicalism.

Restricting the word ‘fundamental’ to the ungrounded substantive facts is somewhat stipulative. But it is well-motivated. Autonomous facts are not fit to be grounded, so the inability of the physicalist to provide a physical ground should not impugn physicalism. Instead of stipulating that ‘fundamental’ refer only to ungrounded substantive facts (and not all ungrounded facts), we might have adopted a more liberal notion of the fundamental, encompassing both the substantive and the autonomous, and construed physicalism as a claim about only the substantive fundamental facts. Not much turns on the choice. Both approaches have merit. Thinking of the fundamental as the metaphysical bedrock, or ground floor, favors the second approach. Thinking of the fundamental as the realm of the brute favors the first approach.<sup>17</sup> The first approach also has the advantage that it does not require a new formulation of fundamentality physicalism, or at least no additional re-formulation to which we are not already committed by focusing on *facts*. If by ‘fundamental’ we mean ‘ungrounded and substantive’, then the definition from Section 2 can remain unchanged. Fundamentality physicalism says, quite simply, that all the fundamentalia are physical. On the current approach, the fundamentalia are facts.

*Fundamentality Physicalism: (fact version)* All fundamental facts are physical.

If, instead, we opt for precisifying the fundamental as ‘the ungrounded (substantive or not)’, then we must modify the definition a bit:

*Substantive Fundamentality Physicalism:* All substantive fundamental facts are physical.

I think the choice between these two is largely terminological, though I prefer the former. The move to facts is necessary within the current ground-theoretic framework. However, the official definition of fundamentality physicalism remains the same as it was on page 5: All fundamentalia are physical. That definition is agnostic on how we construe ‘the physical’ as well as on the types of things that are fundamental: facts, properties, events, objects, or what-have-you.

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<sup>17</sup>Once we precisify ‘fundamental’ as ‘ungrounded and substantive’, the covering constraint (4), which says that the fundamentalia ground all of reality, requires some finessing. The finesse is simple: the sense of ‘fundamental’ in the covering constraint includes both the substantive and the autonomous.

The claim that mathematical facts are fully grounded in autonomous facts is more substantial than restricting the scope of physicalism to the substantive. It rules out any view in the philosophy of mathematics according to which there facts about, e.g. sets, that are not grounded in the natures of sets, in conjunction with other autonomous facts. The best candidates for ungrounded substantive mathematical facts are axioms, such as the powerset axiom in Zermelo-Fraenkel set theory with choice ('ZFC'). Autonomism about the mathematical requires that these axioms be either autonomous themselves or grounded in the autonomous. Strictly speaking, autonomism is agnostic about which autonomous facts ground, e.g. the powerset axiom of ZFC. But the most plausible autonomous candidates are facts about the natures of sets. The nature of the membership relation or other mathematical phenomena might also play a role. Mathematical autonomism is a somewhat controversial, albeit plausible, claim in the philosophy of mathematics. It gets support from the idea that, when we lay down the axioms of a theory, we describe, and partially define, the subject matter about which we speak (Hilbert 1899; Balaguer 1998; Rabin 2007).<sup>18</sup> This contrasts with an approach on which we antecedently grasp the sets, and the axioms describe features of sets that go above and beyond the natures of the sets and related mathematical phenomena (such as the membership relation). Alternatively, even if one accepts that axioms are grounded in autonomous facts about natures, if one also believes that there are mathematical facts that are neither grounded in the axioms of the relevant theory nor the natures of the described mathematical phenomena, one will reject autonomism. For example, neither the continuum hypothesis nor its negation can be proved from the axioms of ZFC (Gödel 1938; Cohen 1963, 1964). Theorists who believe that the continuum hypothesis is nonetheless true, and also reject that its truth is grounded in the nature of sets, are likely to reject mathematical autonomism.

Importantly, Dasgupta (2015) himself does not accept my proposal. He offers mathematical axioms as paradigms of ungrounded substantive facts (577).<sup>19</sup> This not the place for a full discussion of the benefits and costs of

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<sup>18</sup>There are two ways to precisify this idea in an autonomistically-friendly manner. One might claim that the axioms are themselves autonomous. The powerset axiom of ZFC is a partial real definition of what a set is. Alternatively, one could instead claim that the powerset axiom is substantive, but grounded in autonomous facts about the natures of sets. This debate is an infight between autonomists. I will not settle the issue here.

<sup>19</sup>The situation is complicated. While Dasgupta (2015, 577) offers mathematical axioms as examples of ungrounded substantive facts, he may have been doing so to illustrate the distinction between an ungrounded substantive fact and an autonomous fact, without positively endorsing the claim that the axioms are ungrounded. In other work Dasgupta (2016), Dasgupta argues for the view that all

mathematical autonomism. I endorse mathematical autonomism. I similarly endorse grounding autonomism about universals. My reason is simple: there is no more to these domains than there is in the natures of the phenomena under discussion. In other words, there are no brute ungrounded substantive facts about either mathematics or universals. The same is not true for the inhabitants of concrete reality. Electrons and the weak nuclear charge have natures. There are autonomous facts about them. But consider the fact that there are more electrons than protons. This fact is not grounded in the nature of either electrons or protons; if the situation were reversed neither electrons nor protons would have changed their nature and ceased to be what they are. Nor is it grounded in other natures. The position of an electron provides an example of a substantive fact that is not autonomously grounded, but which might actually be fundamental. (Those do not think that particle-positions are fundamental can substitute their preferred fundamental facts, perhaps wave-function facts, or facts about strings.) It's worth thinking about what, e.g. a mathematical fact that was not grounded in natures would be like. Perhaps, unbeknownst to us, the number three has a location: in my pocket. (Two is located in your coffee cup). If this were so, it would be a fundamental substantive fact about mathematics. Nothing in the nature of three would reveal its location. That is what an ungrounded substantive fact about mathematics is: a brute unexplained fact that has nothing to do with the natures of the relevant phenomena. When someone claims that numbers have such properties, we tend to think that they are confused about how numbers work.

My solution to the problem of abstracta, in particular the problems posed by mathematical facts, facts about universals, and grounding facts, is that (a) physicalism requires only that the fundamental facts, i.e. the ungrounded substantive facts, be physical and (b) facts about these domains do not yield any ungrounded substantive non-physical facts, because any grounding work left undone by physical facts is polished off by autonomous facts. (In the limiting case, autonomous facts do all the work). My solution to any worries stemming from moral or ethical domains will be the same. Facts about the wrongness of a particular stabbing will be partly grounded in

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facts are autonomously grounded. This entails that mathematical axioms are autonomously grounded. Dasgupta's claim that all facts are autonomously grounded is part of his defense of a version of the principal of sufficient reason. However, the claim that all facts are autonomously grounded mixes poorly with the formulation of physicalism as a thesis about the nature of the ungrounded substantive facts. If Dasgupta (2016) is right, there are no ungrounded substantive facts. If so, then fundamentality physicalism is vacuously true. But so are fundamentality idealism and dualism. If grounding autonomism is true about everything, then we need an alternative way to define physicalism.



concrete substantive facts about who gripped a knife when, which are in turn grounded in physical fundamentalia. The remainder of the grounding work, if there be any, will be done by autonomous facts, possibly stemming from the natures of the relevant normative properties.<sup>20</sup>

I have coopted the autonomous/substantive distinction from Dasgupta (2015), and put it to work he did not intend. Dasgupta rejects mathematical autonomism (577). His primary concern is the challenge to physicalism from the grounding facts. He does not address other versions of the problem of abstracta, including the problems of mathematics, morality, and universals. I have put the autonomous/substantive distinction to work there. Dasgupta should not be blamed for my sins. Even if one rejects Dasgupta's autonomous solution to the problem of grounding (perhaps opting for the super-internal solution instead), one can still adopt the autonomous solution to other versions of the problem of abstracta. For myself, I actually find the autonomous solution more appealing for mathematics than for grounding facts.

My autonomous solution to the various versions of the problem of abstracta comes with baggage. One must buy into the distinction between substantive and autonomous facts, and believe that physicalism cares only about the former. One must accept that the various domains to be addressed (about mathematics, universals, grounding, and perhaps morality) are either autonomously grounded or grounded in a combination of physical substantive facts and autonomous facts. I should stress that the notion of autonomous facts, i.e. facts inapt for ground, is independent of the claim that things have essences or natures that yield such facts. But facts about essence are plausible candidates for autonomous facts. Essence and autonomy play well together. Thus, enemies of essence, or those who find the notion intolerably obscure, might also hesitate to accept my solution. For these reasons, I offer two alternative proposals, shorn of commitments to autonomy, essence, or controversial theses in the philosophy of mathematics.

#### **4.4. The concrete restriction solution**

The basic idea behind my second suggested solution is to restrict the commitments of fundamentality physicalism to the concrete fundamentalia.

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<sup>20</sup>If there is a remainder of grounding work left undone by the physical, then what one might call *strong naturalism*, analogous to the strong physicalism from 16, will be falsified. But a fallback *weak naturalism*, according to which natural facts do all the grounding work leftover by the autonomous facts, might survive. Thanks are due here to an anonymous referee.

For reasons already canvassed (17), I choose to restrict physicalism's commitments to the concrete fundamentalia, rather than saying that all the ultimate grounds (full stop) of the concrete are physical. The latter restriction runs into problems with concrete facts that have mixed concrete and non-concrete grounds. (Recall the fact that the cookies cannot be evenly distributed to the children in the room.)

*Concrete fundamentality physicalism:* All concrete fundamentalia are physical.

Concrete fundamentality physicalism does fairly well. It does rely on the notion of the concrete, which, though common enough, is like not univocal and can be surprisingly hard to pin down (cf. Marshall and Weatherston 2014). For example, immaterial angels should challenge physicalism. Spatio-temporally located angels might count as concrete. But what if the angels are not so located? If they do not count as concrete, then concrete fundamentality physicalism will be compatible with their existence, which seems like a bad result. Perhaps this view is recherche enough that it can be ignored. I'm not sure. It is worth pointing out here that the inapt for ground solution has little difficulty here: the immaterial angel is unlikely to be autonomously grounded.

One last issue must be finessed. According to law dualism (Chalmers 1996, Chapter 4, pp 127), the only fundamental non-physical facts are psycho-physical laws relating physical states to mental states. If this fact is not concrete, then it is compatible with concrete fundamentality physicalism. Surely this is not correct. The solution here is to broaden the notion of the concrete, which is necessary anywhere on a fact, rather than object, centered approach. The law is concrete, despite not being located in space-time. The sense of concrete that should be operative here is that the relevant facts are concrete if and only if they are *about concreta*. On this understanding, the psycho-physical law is concrete, as are the laws of gravity and the laws governing the evolution of the Schrödinger equation. This broadening of the notion of concrete to cover facts, not just particulars, also accommodates property dualism. A property (fundamentality) dualist maintains that there are fundamental mental properties, but no fundamental mental objects. Conscious quarks provide an example. If concrete fundamentality physicalism cares only about objects, then property dualism does not falsify it. This is a bad result. But if property dualism is true, there are non-physical concrete facts, including the having of consciousness by this particular quark. Why is

this fact non-physical? Because it involves the instantiation of a non-physical property: consciousness.

#### **4.5. The contingency restriction**

Responding to the problem of abstracta requires dividing the basic facts into two camps: those that physicalism cares about and those that physicalism does not. Mathematical facts should fall into the second category; facts about electron positions should be in the first, as should facts about my mental states (if any such facts are fundamental). Metaphysically basic mental facts falsify physicalism, while basic mathematical facts do not. This is merely a statement of the goal; we need a principled way of achieving the desired sorting. Thus far, I have suggested the autonomous vs. substantive and the concrete vs. non-concrete distinction. Perhaps the simplest sorting method uses the familiar tools of modal metaphysics: amongst the ungrounded facts, divide the contingent from the necessary. Physicalism cares only about the contingent facts. This suggestion leads to:

*Contingent fundamentality physicalism:* All contingent fundamental facts are physical.

Contingent fundamentality physicalism holds some promise. First, most of the facts that looks problematic, including mathematical facts, appear necessary. The facts that physicalism should care about, including facts about electron positions and my mental states, appear contingent. Autonomous facts also appear to be, for the most part, necessary. Contingent fundamentality physicalism also has the advantages of familiarity. The contingent/necessary distinction is better understood, and for the most part clearer than, either the autonomous/substantive or the concrete/non-concrete distinction.

My first complaint against contingent fundamentality physicalism is that it is guilty of philosophical piggy-backing: if it works, it does so only because one of the two previously covered solutions does the job. If all autonomous facts are necessary, and all substantive fundamental facts contingent, then contingent fundamentality physicalism will entail substantive fundamentality physicalism. Both assumptions are plausible. If all ungrounded necessary facts are autonomous, and all ungrounded contingent facts are substantive, then substantive fundamentality physicalism will entail contingent fundamentality physicalism. If entailments hold both

way, the two physicalisms will be extensionally equivalent: they will declare physicalism to be true at all the same worlds. However, if contingent fundamentality physicalism succeeds in classifying the appropriate worlds as scenarios in which physicalism is true, it will do so because the fundamental substantive and/or concrete facts are physical and also happen to be contingent.

The second complaint against contingent fundamentality physicalism is that it needs things to work out just right regarding which facts are contingent. While the previously discussed connections between autonomy and necessity as well as between substantivity and contingency are plausible, contingency fundamentality physicalism becomes significantly less plausible once they are relaxed. Physicalism should require that fundamental laws of nature (e.g. laws of gravity, of electromagnetism, of psycho-physical relations) are physical. But if laws of nature are necessary, as some have claimed (Shoemaker 1980; Swoyer 1982; Bird 2005), then contingent fundamentality physicalism declares psycho-physical laws of nature irrelevant to the status of physicalism. This cannot be correct. Similar points apply to a necessarily existing God. She does not challenge contingent fundamentality physicalism.

Contingent fundamentality physicalism, much like modal physicalism before it, does not, in my opinion, really get to the heart of the matter – to the facts that should and should not challenge physicalism and why. However, contingent fundamentality physicalism does have the advantages of familiarity and clarity. For those who like fundamentality physicalism but have reservations about the inapt for ground and the concrete restrictions, contingent fundamentality physicalism might be the favored option.

## 5. Conclusion

My main goal in this essay was to introduce fundamentality physicalism and its key concept: *fundamentality*. That notion can be precisified in several ways, using the notion of ground or related forms of metaphysical dependence and/or the distinction between substantive and autonomous facts. Such precisification are necessary to deal with the problem of abstracta, the main threat to a fundamentality-oriented formulation of physicalism. My preferred solution is the ‘inapt for ground’ solution. But I recognize that some readers may be hesitant to accept the philosophical commitments necessary to get that solution running, most importantly the autonomous/substantive distinction and certain claims in the

philosophy of mathematics. For those readers, I offer alternative proposals: the contingent and concrete restrictions.

The move toward a metaphysical dependence oriented conception of physicalism is growing. Grounding-definitions have been offered in Dasgupta (2015), Goff (2017), and Schaffer (2009, *forthcoming*).<sup>21</sup> But modal physicalism still holds much power. It is the form of physicalism that has dominated the massive literature on physicalism, the physicalism-dualism debate, and the metaphysics of consciousness over the past 30 years.

Discussions of physicalism often start with the creation test (Section 1.1), usually illustrated with the metaphor of God constructing the world (Jackson 1993). When imagining God's construction project, we tend to envision starting with a blank slate. That picture requires rethinking. When God arrives at the world's construction site, some of reality is already in place: the autonomous facts. They are part of reality, but are not negotiable or available for creation by God. Physicalism asks, 'Of the things God needs to create, are they all physical?' If they are, then physicalism is true, even if some features of reality, such as mathematical entities or universals, are not physical. Medieval philosophers worried about a tension between God's omnipotence and his apparent inability to violate the laws of logic. Eventually, many came to the conclusion that the inability to violate the laws does not challenge God's omnipotence, because that omnipotence requires only the ability to do that which can be done (Aquinas 1274/1920). Similarly, say I, the physical's inability to ground facts about mathematics or abstract objects does not impugn physicalism's status. Those facts were not on the table for grounding in the first place.

Fundamentality physicalism is a substantive thesis worthy of wearing the title 'physicalism'. It is the form of physicalism relevant to much of the contemporary debate. David Lewis praised modal formulations for their lack of 'dubious' claim of ontological priority. I contest the 'dubious' status of such claims. They are perfectly respectable. This essay does some work to explain what is meant by them. Furthermore, as I have argued, to solve the problem of extras, modal formulations must at

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<sup>21</sup>Two advantages of formulating physicalism in terms of fundamentality, rather than ground, are worth mentioning. First, someone who likes the notion of fundamentality, but distrusts talk of ground, can accept fundamentality physicalism but not a grounding formulation. Wilson (*forthcoming*) provides an example of such a person). Second, if we construe 'fundamental' in a more precise way, as meaning something like 'not dependent' and 'substantive/concrete', then the problem of abstracta will falsify grounding physicalism ('everything is grounded in the physical') but not fundamentality physicalism.

some point rely on the the notion of fundamentality or cognates. Modal formulations do not, in the end, avoid dirtying their hands with idioms of metaphysical dependence. Once we are down in the dirt, we must face the obstacles, primarily the problem of abstracta. I have done my best to grapple with these difficult issues.

Fundamentality physicalism is vastly preferable to modal physicalism. It describes more accurately what has actually been at stake all along: whether some non-physical features, in particular mental features, are fundamental constituents of reality. Even if a fundamentality-centered conception of physicalism is more risky than its modal brethren, the risk is well worth the reward.

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