A defense of idealism

submitted to the Central European University in partial fulfillment of the requirements of the degree of Doctor of Philosophy

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2015

Abstract

This dissertation defends idealism. Chapter 1 defines idealism as the thesis that physical objects are ideal, with ideal objects defined as objects the existence of which necessitates the existence of subjects who can observe them. The definition is fine-tuned in various ways, and it is related to recent theories of metaphysical fundamentality. Chapter 2 reconstructs three contemporary arguments for idealism, Howard Robinson's argument against real matter and John Foster's arguments against real space. I claim that Robinson's argument is open to the objection that spacetime is real, but this objection, in turn, is blocked by Foster. Chapter 3 presents a new argument against real spacetime from a puzzle about relativity. Chapter 4 looks at two metaphysical objections to idealism, the truthmaker objection, which says that the idealist cannot supply truthmakers for physical truths, and the nomic objection, which says that the idealist cannot explain laws. I argue that these objections can be deflected in two ways, in a sparse Humean way and in a theistic fashion.

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Acknowledgments

I would like to thank Howard Robinson for allowing me to be an elephant in his idealist china shop and for wading through an endless series of less than perfect drafts for this essay. Without his help and encouragement, I would have had no chance of completing this project. I also owe him a large general debt for insights on metaphysics, the philosophy of mind, and on the proper way to formulate philosophical arguments.

I would also like to thank Mike Griffin for invaluable advice on Leibniz and Kant, for comments on drafts of Chapter 1 and the main argument, for lots of help in securing travel grants, and for buying me beer and hot chicken wings all the time. I'm grateful to Hanoch Ben-Yami for advice on Chapter 3, to Katalin Farkas for the basic idea behind the definition of ideality that I propose, to Dean Zimmerman for comments on Chapter 1 and for making my research trip to Rutgers University possible, to the two reviewers, Barry Dainton and Philip Goff, for amiably and helpfully pointing out an army of unclarities and *non sequiturs* in the first version of the dissertation, to Anna Marmodoro for advice on my reconstruction of the Power Regress, and to Nikoletta Nemesi for going through Chapter 1 with a fine comb and pressing me to introduce ideality$_4$.

The drawings of Alice and George in Chapter 3 are by Krisztina Óré.

Materialism is an erroneous way of life, deriving from
an erroneous way of thought. Materialism derives from
the habit of hanging the head and looking down to matter,
instead of looking out with a level gaze on the given of sense,
and then looking up to God who gave it.

A.A. Luce (1954: vii)

Introduction

This dissertation is a defense of idealism in the context of analytic metaphysics. It constructs a definition of ideal physical objects, it shows how the hypothesis that physical objects are ideal can be motivated by puzzles in the philosophy of physics, and it argues that there are no decisive reasons for preferring physical realism to idealism, especially if idealism is upheld in conjunction with theism.

Investigating idealism in the context of analytic metaphysics is worthwhile for two reasons. (i) Idealism is a venerable doctrine that was hugely influential in the history of modern philosophy. It is reasonable to ask whether it can be reformulated and defended in contemporary terms. (ii) Philosophers of mind usually embrace some form of physicalism nowadays, dismissing idealism out of hand and treating the dualist minority as an anomaly that is hard to eradicate. It is worth one's while to ask whether the establishment can feel safe about this attitude. To sum up, investigations of idealism are well in order because they can challenge the physicalist orthodoxy while reconnecting metaphysics with an important historical theme.

I emphasize that whenever "idealism" is used in this dissertation, I mean an ontological thesis about the relationship between the mental and the physical, the kind of thesis familiar from Berkeley and (on certain views[1]) from Leibniz. Nothing that I say is meant to concern any other doctrine that is or was or could be called "idealism," such as transcendental, absolute, objective, and Platonic idealism, idealism conceived as a belief in noble principles etc.[2]

[1] E.g. Adams (1994: Part III). The theory I defend below also bears some resemblance to the doctrines of the Yogācāra school of Buddhism (see Tola and Dragonetti 2004).

[2] The meanings of "idealism" are so disparate that not even family resemblance unifies them. See Burnyeat (1982) for an argument that Greek idealism was a form of realism. For two unusually clear takes on Kant's less than pellucid doctrines, see van Cleve (1999) (who portrays Kant as a cautious Berkeley) and Langton (1999) (who makes him into a Locke). For opposing views on German Idealism, see Ameriks (1987) (who thinks that "idealism" has no meaning in Hegel's case), Pippin (1991) (who sees Hegel as a Kantian), Stern (2009) (who thinks that Hegel's idealism is a sort of Platonism), Beiser (2002: 351–5) (who portrays German Idealism as a form of vitalist Spinozism), and Brandom (2009) (who thinks that German Idealism prefigured his own brand of pragmatism). See Sprigge (1983, 1993, 2006: Ch. 5) for an interpretation of British Absolute Idealism as a from of panpsychism, and Quinton (1972) for the thesis that their core doctrine was holism. (Ewing (1934) offers a piecemeal analytic critique of Absolute Idealist tenets.) Putnam (1978: 18) calls verificationism a form of idealism. One sometimes also hears about "linguistic idealism," a mythical postmodern doctrine on which language creates reality (see Fodor (1998: 36) for such a use of the word).

My defense of idealism will be a defense of the following argument:

(I) If physical realism is true, then the particles and fields studied by fundamental physics are real.

(II) If physical objects are real, they have real categorical properties.

(III) The only categorical property of the particles and fields studied by fundamental physics is spatiotemporal position.

(IV) Spatiotemporal position is not a real property.

(V) Therefore, physical realism is false.

Chapter 1 constructs a definition of idealism in order to clarify what idealism amounts to and what "real" in (I), (II), and (IV) means. I propose to define idealism as the thesis that actual physical objects are not real but ideal. By "ideal objects" I mean, roughly, objects that cannot exist without being observable by someone. The definition has a fully Chisholmed version as well, developed in the course of engaging with a series of counterexamples.

Chapter 2 reconstructs three arguments for idealism: Howard Robinson's Power Regress, John Foster's Scrambled World argument, and John Foster's Gappy World argument. The first of these is a proof that matter is not real. Foster's two arguments prove that spacetime isn't real. The three arguments together prove that neither matter nor space is real, hence the physical world is not real. I claim that these arguments complement each other in the sense that Foster defuses the only significant objection to Robinson. Chapter 2 is meant to establish (II), (III), and (IV), and it argues that (I) is tenable in the context of the present defense (I'll come back to this proviso in a moment).

Chapter 3 is a new argument against the reality of spacetime, offered in further support of premise (IV). I claim that a puzzle discovered by Einstein and still hotly debated today, the conventionality of distant simultaneity, is easily solved by idealism and is very hard to solve under physical realism.

Chapter 4 examines whether idealism is to be rejected on grounds unrelated to the structure of physical objects. I examine two basic objections. The first says that idealism cannot supply truthmakers for physical truths and the second says that idealism cannot explain the existence of natural laws. I argue that the idealist can supply truthmakers for physical truths and can ground the existence of laws in at least two ways, in a sparse Humean way that is potentially revisionary with respect to our ordinary beliefs, and in a theistic way that can preserve most of our ordinary beliefs.

This dissertation is a *defense* of idealism, not a proof of it. By a "defense of theory Θ," I mean an argument establishing that theory Θ is (i) consistent, (ii) well motivated by certain puzzles in its domain, and (iii) unlikely to be considered inferior to its rivals by ideal agnostics.

By "ideal agnostics," I mean (hypothetical) addressees of philosophical arguments who have no convictions or intuitions whatsoever about the domain under scrutiny (the domain at hand being the ontology of the physical world). I envisage philosophical argumentation as akin to a trial: a case is presented for and against some theory (in our case, idealism), and a group of ideal agnostics pass a sentence solely on the basis of the strength of the arguments, without any regard to private convictions and intuitions. If, from this objective viewpoint, there is reasonable doubt that the theory on trial is false or that it is inferior to its rivals, then the defense is successful.[3]

Ideal agnostics don't exist. Worse, the participants of actual philosophical debates will have conflicting opinions about what an ideal agnostic would say in a given situation. Still, my dissertation will proceed under the pretense that ideal agnostics exist, because constructing a defense under such a pretense is enough to address the two core issues that make idealism interesting in the contemporary situation. Constructing a defense is sufficient for showing that idealism can be reformulated in contemporary terms, because a defense must establish that the theory being defended is coherent, which, in turn, requires formulating it. And a defense of idealism is sufficient for challenging the physicalist orthodoxy, since a successful defense of idealism will show that idealism is not inferior to physical realism from an objective standpoint.

To keep the discussion within reasonable limits, I will stage my defense of idealism as a defense of idealism against one particular form of physical realism that I'll call "standard physical realism." This is, roughly, the view that physical objects are real, they are constituted by some fundamental physical stuff, which is likewise real and is known from fundamental physics, and neither this fundamental physical stuff nor the ordinary macroscopic objects that it makes up are sentient, proto-sentient, or teleologically or in some other sense essentially directed toward mentality. This is a tenable, and, arguably, quite prevalent form of physical realism. If idealism proves to be at least as good an ontology as standard physical realism (in the eyes of ideal agnostics), then the claim that idealism is not a live option in metaphysics loses all of its credibility.

[3] For more on ideal agnostics, see van Inwagen (2006: 44–49). Note, however, that on van Inwagen's conception, a defense of theory Θ is successful iff it turns ideal agnostics into believers in Θ. In contrast, I only require a defense to instil reasonable doubt that Θ is false.

1 The concept of idealism

The goal of this opening chapter is to clarify the concept of idealism. I'll define idealism as the thesis that physical objects are ideal, and I'll define ideal objects (roughly) as objects that necessarily coexist with subjects who can observe them. The chapter argues that the proposed definition captures the necessary and sufficient metaphysical condition of idealism, it is superior to extant rival formulations of idealism, and, once appropriately fine-tuned, it is immune to counterexamples.

Section 1.1 kicks off the dialectic by arguing that idealism has no standard analytic formulation today and the formulations that are on the table fail to meet the basic criterion for being a definition, because their definiens isn't better understood than the definiendum.

Section 1.2 introduces the proposed definition of idealism. I'll define idealism as the thesis that actual physical objects are ideal and I'll define ideal objects as objects that necessarily coexist with subjects who can observe them. I'll also construct a theistic variant of the definition, one on which ideal objects are objects that can only exist if God is disposed to make subjects observe them. I'll argue that the claim that physical objects are ideal in the sense indicated is necessary and sufficient for the truth of idealism, hence this claim captures the core metaphysical commitments of idealism.

Section 1.3 looks at a series of counterexamples to the proposed definition of ideal objects. The counterexamples typically involve objects that are classified as ideal by the proposed definition but are, or can be conceived as, real. By engaging with these puzzles, I'll construct a fine-tuned version of the definition of ideal objects, one that is immune to counterexamples.

Section 1.4 engages with the problem of grounding. Recently, concepts of fundamentality, grounding, and dependence have become prominent in analytic metaphysics, and some metaphysicians argue that theories like idealism and physicalism are to be framed as theories about grounding (fundamentality etc.) and not in modal terms. I'll argue that the modal criterion proposed here meets the formal and substantive criteria invoked in at least one extant characterization of grounding, hence the charge that my proposed definition of idealism should be replaced by a grounding claim is not very well motivated.

1.1 Problems about defining idealism

Since idealism is virtually never discussed in contemporary metaphysics and philosophy of mind, it lacks a standard analytic formulation. Indeed, it even lacks a standard *non*-analytic formulation—there is no single slogan, awaiting analysis, that one could identify with idealism. Or so I'll argue here. Consider the following proposals for a first-pass definition of idealism:

(1) Fundamental reality is mental.

(2) The physical world is mind-dependent.

(3) There is no external world.

These slogans are certainly suggestive of idealism. But they have very little analytic cash value, or, at any rate, not enough to buy us a definition that can be used without further ado to develop arguments for idealism. A good definiens is better understood than the definiendum—there is no point explaining something through concepts that are harder (or just as hard) to grasp than the concept that is being explained. But proposals (1)–(3) violate this rule.

Proposal (1) violates this rule because "fundamental reality" hardly wears its meaning on its sleeve. The phrase is deeply suggestive, but it is not backed by a familiar everyday concept, nor by a relatively well understood scientific notion that is applicable here. Even worse, its philosophical profile is unclear, because the formal and substantive characteristics of fundamentality are controversial. (See 1.4.) So (1) defines idealism through a concept that isn't better understood than idealism itself. Similar remarks apply to (2), since the concept of ontological dependence is about as clear as the concept of fundamentality.

The worth of (3) depends on what one means by "external world." On one reading of the phrase, even the idealist can agree that there is an external world. The idealist surely has the right to say that there is a *phenomenally* external world, some sort of construction out of actual and possible experience. So in order to give (3) a physical realist spin, one must emphasize that one is denying the existence of a *real* external world. But then the weight of the definition will be carried by the concept of being *really* external, and this concept, in turn, is hardly better understood than idealism itself.

Instead of (1)–(3), one might suggest the classic Berkeleyan slogan:

(4) *Esse est percipi vel percipere*.

This thesis is often presented as the classic definition of idealism. But its meaning is unclear, because it is unclear what it takes for the *esse* of something to be to φ (e.g. to be perceived). The only interpretation that readily springs to mind is the following:

(5) The being of x is to φ $\equiv$ $\Box$(x exists iff x φs)

Using (5), one can clarify (4) as

(4*) $\Box$ For all *x*, *x* exist iff *x* is perceived or *x* perceives.

But (4*) fails to fit even Berkeley's own metaphysics. Berkeley sometimes suggests that the existence of physical objects reduces to conditionals about experience:

> The table I write on, I say, exists, that is, I see and feel it; and if I were out of my study I should say it existed, meaning thereby that if I was in my study I might perceive it, or that some other spirit actually does perceive it. (*Principles* §3, II: 42)

> [F]or the question, whether the earth moves or no, amounts in reality to no more than this, to wit, whether we have reason to conclude from what hath been observed by astronomers, that if we were placed in such and such circumstances, and such or such a position and distance, both from the earth and sun, we should perceive the former to move among the choir of the planets. (*Principles* §58, II: 65f)

> HYLAS: Pray let me see any sense you can understand [the first book of Genesis] in.
>
> PHILONOUS: Why, I imagine that if I had been present at the Creation, I should have seen things produced into being; that is, become perceptible, in the order described by the sacred historian. I ever before believed the Mosaic account of the Creation, and now find no alteration in my manner of believing it. [...] [W]hen things before imperceptible to creatures, are by a decree of God, made perceptible to them; then are they said to begin a relative existence, with respect to created minds. (*Third Dialogue*, II: 251f)[4]

These passages imply that physical facts are reducible to facts about what is or *would be* perceived. But if, say, the existence of this table reduces to the fact that it is perceived or *would be* perceived if someone entered this room, then (4*) is false, because it is possible that the table (which, presumably, does not perceive itself) exists when nobody perceives it.

But even if we disregard this historical point, it is hard to see why the idealist would be by definition bound to the view that brute physical objects go out of existence when they cease to be observed. But (4*) commits the idealist to that view. It also suggests that we don't exist when we are dreamlessly asleep and nobody watches us, which is implausible. Moreover, (4*) treats idealism as a necessary truth. It is hard to see why an idealist would be forced to treat dualism and physicalism as impossible. So (4*) is unduly restrictive, and since it is hard

[4] See Foster (1982: 22ff) and Winkler (1989: 205f) for more on this reductive Berkeleyan doctrine.

to see any other interpretation of (4) except for (4*), (4) fails as a definition of idealism.

Let's turn to suggestions by contemporary advocates of idealism. John Foster recommends a definition of idealism along these lines:

> (6) The existence of minds is something over and above the obtaining of physical facts, but the existence of physical objects is nothing over and above the obtaining of facts about minds. (based on Foster 1982: 5–7)

This formulation is problematic because the meaning of "is nothing over and above" is unclear. It sounds like a heavyweight metaphysical notion, one which (to my knowledge) isn't any better understood than idealism itself.

Howard Robinson formulates idealism in the following way:

> (7) "The physical world exists only as a complex feature of experience; it exists only 'in the minds of' those who do or might experience it." (Robinson 2009: 203)

This sentence cannot define idealism because the meaning of "existing as a complex feature of experience" is unclear. (7) seems to mean something like Berkeley's slogan, but then we are back to the problems discussed under (4).

Timothy Sprigge offers the following formulation:

> (8) "[T]he noumenal backing [of the physical world] consists in innumerable mutually interacting centres of experience, […] where by 'experience' is meant reality of the same general kind as that of which each momentary centre of experience which is our consciousness at any time is a 'high-grade' instance." (Sprigge 1983: 85)

This formula is almost wholly occult. Whatever noumenal backings are, their concept isn't better understood than idealism itself.

Finally, consider the following suggestion by Robert Adams:

> (9) There are no unperceiving substances, and spatiotemporal relations are reducible to internal features of consciousness. (based on Adams 2007: 47–9)

This definition uses the concept of substance, which is probably the single most difficult concept in metaphysics, one that certainly isn't better understood than idealism. (If you disagree, please read *Metaphysics* Z and Berkeley's *Dialogues* in quick succession.) Note, further, that (9) cannot be amended by replacing "substances" with "entities," because the resulting thesis will entail that there are no unperceiving objects. But the idealist surely isn't by definition forbidden to think that there are (unperceiving) tables and chairs (not real ones, of course, but some sort of constructions out of experience).

It seems safe to conclude that the analytic definition if idealism is far from settled. This is bad news, because without a clear understanding of the positive claims of the idealist, arguments against materialism can backfire. Suppose, for example, that eccentric Eric finds (1)–(9) meaningless but he is convinced by contemporary idealists that (i) the physicalist conception of matter involves a vicious regress (Robinson 2009) and (ii) the physicalist conception of spacetime is contradictory (Foster 1982: 162–75). Eric's position is not incoherent, for it might be the case that there is no intelligible conception of idealism but the physicalist conception of matter *is* viciously regressive and the physicalist conception of spacetime *is* contradictory. That would be the case, for example, if all our conceptions of reality were ultimately senseless. Eric, who finds idealism unintelligible but accepts the arguments just mentioned, has warrant for that claim. But it can hardly be the goal of the idealist to support a view like Eric's (even if there are no real people like Eric). The idealist needs a definition that makes her positive claims clear. And the physical realist needs that definition too. You cannot disagree with something you don't understand.

1.2 Introducing a definition

My proposed definition of idealism says, roughly, that actual physical objects essentially coexist with subjects who can observe them. My proposal is close to the "*esse est percipi*" slogan (at least if we use (5) to interpret the latter), but instead of saying that the *esse* of physical objects is to be perceived, I'll claim that their *esse* is to be observable. (Fine print to follow.)

I'll frame my proposed definition in terms of a distinction between real and ideal objects. The category of the real and the category of the ideal are meant to be disjoint: no real object is ideal. Moreover, these categories are meant to be exhaustive in the sense that everything is either real or ideal or composed of both real and ideal things. I'll also be committed to the thesis that *being real* and *being ideal* are essential properties. Nothing is contingently real or ideal.

Here are the first-pass definitions of reality and ideality, to be fine-tuned later:

Reality:

O is real $=_{df}$ O is not ideal

Ideality:

O is ideal $=_{df}$

$\Box$ For all t, O exists at t $\supset$ Some subject S observes O at t
or S would have observed O at t if S had performed some exploratory action prior to t.

By "exploratory actions," I mean actions that lead directly to observation, e.g. by making an object visible from the subject's vantage point or making it impact the subject's senses in some other way. Exploratory actions include moving, looking at things, listening, touching, smelling, and tasting, and using instruments like spectacles, microscopes, cameras etc. Exploratory actions are all and only those actions the sole function of which is to lead directly to observation.

It might be objected that introducing the notion of exploratory actions violates the principle that the definens of idealism must be better understood than the definiendum, so my proposed definition won't be better off than (1)–(9). But this worry is mistaken. I'm not introducing a new concept about a special type of action. I'm merely using "exploratory action" to refer to those actions that we ordinarily take to directly facilitate observation.

Ideality is meant to involve our *ordinary* concept of observation, the one we use in everyday life and in scientific contexts to express the fact that some concrete entity was perceived or was inferred on the basis of perception. And *Ideality* is meant to involve a *wide* concept of observation, one on which it makes sense to say things like the following: I observed my neighbor steal my morning paper today, scientists at CERN observed the Higgs boson, a blind person observed the train leave the station. (In contrast, a *narrow* concept of observation would restrict the notion to the visual modality, ruling out the third example, and/or to immediate objects of perception like a temporal part of my neighbor or a digital reconstruction of a scattering event, ruling out the first two examples.)

Ideality entails that things might exist without being real. (Ideal objects, if there are any, exist but they are not real.) This consequence of *Ideality* may offend the ears of those philosophers who take "exist" and "real" to be synonymous. If you are one of those philosophers, I ask for your indulgence on the following grounds: I propose to use "exist" in a lightweight sense that relates existence to the truth of quantified sentences—*F*s exist iff there are *F*s. Since the idealist surely has the right to say that there are tables (not real ones, of course, but some sort of constructions from experience), distinguishing existence from reality makes philosophical sense in the present context.

With these preliminaries in place, one can define idealist worlds as worlds where all physical objects are ideal, and one can define physical realist worlds as worlds where some physical objects are real. And one can define idealism as the thesis that our world is an idealist world and one can define physical realism as the thesis that our world is a physical realist world. In short:

Idealism:

All actual physical objects are ideal.

Physical realism:

Some actual physical objects are real.

Assuming that real things are either physical or mental and that there must be real things for there to be anything, *Idealism* entails that there are real mental entities. I'll assume that these are immaterial minds, but I'll remain neutral about their structure (e.g. whether they are bundles of sensations, simples etc.).

The requirement that there must be real things for there to be anything will be taken as axiomatic. The assumption that real things are either physical or mental can perhaps be doubted on the grounds that there might be entities that belong to alien sortals and are neither physical nor mental. I'll assume that worlds where some things are neither physical nor mental contradict both idealism and standard physical realism, and hence they are not relevant for the present defense.

My final core assumption is that the ideality of physical objects entails that their properties are also ideal, in the following sense:

Ideal properties:

Property P is ideal $=_{df}$

$\Box$ For all t, something is P at t $\supset$ Some subject S observes at t that x is P or S could have observed at t that x is P if S had performed some exploratory action prior to t.

1.2.1 The basic criterion

Does *Idealism* satisfy the basic criterion that the definiens should be better understood than the definiendum? If it does, then *Idealism* is superior to (1)–(3) and (7)–(9) as a definition, because the latter violate that criterion.

Idealism appears to conform to the criterion in question, because its parts are relatively well known and clearly better known than idealism. *Idealism* involves the concept of physical objects and, via *Ideality*, the concepts of observation, exploratory action, possible worlds, and counterfactual truth. To understand the proposed definition, one only needs modal notions plus an idea of what physical objects are and what observation is. Arguably, these concepts are relatively well known and certainly better known than idealism itself.

1.2.2 Historical comparisons

The next question is whether *Idealism* is a necessary and sufficient condition of idealism. In this section, I argue that it is a necessary condition, because it is implied by historical forms of idealism. Consider the following four historically inspired theories about the nature of physical objects:

(I1) Physical objects are sums of immaterial mental particulars.[5]

(I2) Physical objects are confused representations of other immaterial minds.[6]

[5] Berkeley: *Principles* §48 (II: 61), *Third Dialogue* (II: 249).

[6] On this Leibnizian idea, see Adams (1994: 241–53) and Hartz (1992). Note that Leibniz wavered between an idealist and a realist interpretation of the thesis that physical objects are collections of monads. (I2) is not meant to beg any hermeneutical questions about this issue. It represents a possible idealist reading of the doctrine in question.

(I3) Physical facts are facts about potential immaterial perceptual states.[7]

(I4) Physical fact are facts about archetypes in God's mind.[8]

These toy theories resemble physical ontologies proposed by Berkeley and Leibniz. Since Berkeley and Leibniz are the most important idealists in the history of philosophy, we have a good heuristic argument for the adequacy of *Idealism* if *Idealism* classifies (I1)–(I4) as forms of idealism.

Let's say that (I1)–(I4) are claims about *actual* physical objects, so that idealism is not assumed to be a necessary truth. *Idealism* will then classify (I1) as a form of idealism iff sums of immaterial mental particulars must coexist with immaterial minds who can observe them. Presumably, this can be taken for granted in a Berkeleyan context, since Berkeley believes that ideas are mental particulars that always come with a mind attached.

Idealism classifies (I2) as a form of idealism if representations of immaterial minds must be the intentional contents of mental states. More precisely, (I2) implies *Idealism* iff the following plausible principle holds:

(I2+) If some immaterial minds are represented in a confused manner, then there is a mind *M* such that *M* observes the representation in question.

If (I2) is conjoined with (I2+), then the existence of physical objects (= the existence of confused representations) requires the existence of minds who can observe them, which, in turn, entails *Idealism*.

Idealism classifies (I3) as a form of idealism if there cannot be facts about potential immaterial perceptual states without the existence of immaterial minds who are the potential owners of the perceptual states in question. This claim sounds plausible in an idealist context, since, intuitively, whatever facts there are in idealist worlds are facts that concern minds; specifically, facts about potential perceptual states concern minds that can have perceptual states with the kind of content in question. So (I3) entails that whenever there is a physical object (= whenever there are facts about potential experiences of specific sorts), there are subjects (the potential bearers of those experiences) who can observe the object in question, hence (I3) entails *Idealism*.

To assess (I4), let's assume that divine archetypes are parts of God's conception of the physical world, constituting the divine blueprint on the basis of which God causes us various experiences. With this presupposition in place, *Idealism* classifies (I4) as a form of idealism iff the existence of archetypes requires the existence of created subjects who are the intended recipients of the experiences based on the archetypes. For then it follows that the existence of

[7] Berkeley: *Principles* §3 (II: 42), §58, (II: 65–6), *Third Dialogue*, II: 251.

[8] Berkeley: *Third Dialogue* (II: 248). For more on Berkeley's theory of divine archetypes, see Daniel (2001), Foster (1982: 22ff), and Winkler (1989: 205f).

physical objects entails the existence of archetypes, while the existence of archetypes, in turn, entails the existence of subjects who can have the experiences based on the archetypes, so the existence of physical objects entails the existence of subjects who can observe the objects in question, so *Idealism* is true.

On the other hand, if divine archetypes can exist in the absence of created subjects, then (I4) does not entail *Idealism*. For then in some possible worlds, there are physical objects (because God has certain archetypes in His mind) but there are no subjects who can observe the objects in question.

To sum up, three out of four historical forms of idealism are quite easily accommodated by *Idealism*. The fourth can be taken on board by allowing for the following alternative definition of ideality:

<u>Ideality</u> *(theistic version):*

(IT) O is ideal $=_{df}$

$\Box$ For all t, O exists at t $\supset$ God is causing some S to observe O at t
or God is disposed to cause created subjects to observe O at t
if created subjects perform some exploratory action prior to t.

This alternative definition is wholly in the spirit of the original. To see why, consider the following simplified versions of the two definitions:

<u>Ideality</u> *(standard version):*

(IS) O is ideal $\approx_{df}$

$\Box$ O exists at t $\supset$ O is observed or observable by someone at t.

<u>Ideality</u> *(theistic version):*

(IT) O is ideal $\approx_{df}$

$\Box$ O exists at t $\supset$ God is causing or is disposed to cause
created subjects to observe O at t.

If O only exists in worlds where there are created subjects at all times during the history of the world, then O is ideal in the sense of (IS) iff it is ideal in the sense of (IT) (assuming, for the sake of illustration, that God exists), so the two definitions coincide for worlds where history contains finite minds throughout.

The two definitions only come apart when we consider worlds without subjects and worlds where history does not always contain subjects. The theistic definition allows for the existence of ideal physical objects even in these cases, but the standard definition does not. So the theistic definition can be seen as an extension of (IS) to accommodate the hypothesis that physical objects may exist in the absence of finite minds.

To sum up, *Idealism* appears to harmonize with historical forms of idealism if we take into consideration a kindred but more permissive theistic definition of ideality (which I'll do when I state the official version of the definition). This corroborates the hypothesis that *Idealism* contains the seeds of a necessary condition of idealism.

1.2.3 Clash with physical realism

Idealism contradicts physical realism, so it is a sufficient condition for the truth of idealism. Or so I'll argue here.

Under (IS), *Idealism* contradicts physical realism iff physical realism entails that some actual physical object could have existed without being observable. Arguably, physical realism does entail that, since physical realism (in its standard form, at any rate) allows for the possibility that physical objects could have failed to coexist with subjects. Take, for example, a world where something very much like our history unfolds from the Big Bang until 10 billion years ago, but then, because of a cosmic catastrophe, lethal radiation is unleashed and life never develops. Or take a world that ends shortly after the planets are formed. Such worlds are eminently conceivable if we assume that the ontology of inanimate physical objects has nothing to do with our minds. And since the existence of these worlds entails that some physical objects are not ideal in the sense of (IS), it follows that *Idealism* contradicts (standard) physical realism if (IS) is adopted as the definition of ideal objects.

Under the theistic definition of ideality, *Idealism* contradicts physical realism iff physical realism entails that some physical object could have existed without God being disposed to make subjects observe it.

Suppose that physical realism is true, and suppose that a possible world called "Hidden-α" contains all actual physical objects. Indeed, Hidden-α is an almost perfect duplicate of the actual world. The only difference is that, at Hidden-α, the following conditional is true: If God creates subjects, then, come what may, God prevents them from observing Alpha Centauri. In Hidden-α, God is intent to deceive created subjects about the structure of the world by hiding a specific star from them. This is surely conceivable if God exists and if Alpha Centauri is a real star shining out there in space, regardless of what we do or think.

If physical realism is true, then Hidden-α exists, and if Hidden-α exists, then an actual physical object (Alpha Centuri) is not ideal in the sense of (IT). Alpha Centauri exists in Hidden-α yet God it not disposed to make subjects observe Alpha Centauri in Hidden-α. Hence, if physical realism is true, then not all physical objects are ideal in the sense of (IT), in other words, *Idealism* coupled with the theistic definition of ideality also contradicts physical realism. Hence, *Idealism* in general contradicts physical realism, which means that *Idealism* is a sufficient condition of idealism in the context of a debate between idealism and (standard) physical realism.

1.2.4 The story so far

I have introduced a definition of idealism and I have argued that (i) it satisfies the most important criterion for being a definition, and (ii) the truth of its definiens is both necessary and sufficient for the truth of idealism.

The proposed definition says, roughly, that actual physical objects necessarily coexist with subjects who can observe them. (An alternative, more permissive version says that actual physical objects only exist in worlds where God is disposed to make subjects observe them.) I claimed in 1.2.1 that this definition satisfies the basic criterion for being a definition, because it is built on modal notions, the notion of physical objects, and the notion of observation, which are, arguably, better known than idealism itself. In 1.2.2, I argued that the proposed definiens is contains the seeds of a necessary condition of idealism because three out of four historical forms of idealism entail it. In 1.2.3, I argued that the definiens is a sufficient condition, because it contradicts physical realism.

I conclude that the core metaphysical commitment of idealism is probably *Idealism*, provided that we take note of the theistic alternative. I'll remain neutral about the choice between the standard and theistic formulation until Chapter 4. For the sake of simplicity, I'll use the standard version whenever the choice between the two makes no substantive difference.

1.2.5 Too thin?

It might be objected that the proposed definiens is "too thin" in the sense that it involves mundane modal and intentional concepts only and none of the exotic stuff (sense data, monads etc.) that one might expect from an idealist ontology. One might expect a definition of idealism to tell us *how* physical objects are constructed from mind-stuff. But the proposed definiens is a bare-bones modal condition about observation.

I reply that this is a feature, not a bug. My goal is to capture the minimal metaphysical condition of idealism. I have argued that *Idealism* states a necessary and sufficient condition of idealism, hence its truth is equivalent to the truth of idealism. So thin or not, it *is* the core metaphysical commitment of idealism.

It might be objected that the definiens is too thin anyway. One might expect a definition of idealism to tell us an intricate story about immaterial minds and the way their activity gives rise to a physical world.

My reply consists of two points. First point. Clearly, there are a number of distinct conceivable idealist explanations of how physical objects are constructed from mind-stuff, involving competing views about the metaphysics of the mental. For example, it sounds *prima facie* quite plausible that idealism can be upheld in conjunction with a commitment to sense data or in conjunction with adverbialism about the content of sensory perception. And there might be still other options available, both in the metaphysics of perception and with respect to other aspects of the metaphysics of the mental (e.g. whether minds are simple or complex).[9]

[9] See Wilson (1999) for an illuminating historical comparison between the idealisms of Berkeley and Leibniz. Simons (2001: 63) suggests that Leibniz was an adverbialist, which would already put him in opposition to Berkeley. Hartz (1992) explores the internal variety of Leibniz's view.

Second point. Given the first point, any specific story about how physical objects are constructed out of mind-stuff will presuppose some substantive and possibly controversial thesis about some aspect of the metaphysics of mind. But the truth of idealism obviously does not *depend* on which of those competing alternative explanations are correct. Idealism is true if physical objects are collections of sense data, it is true if physical objects are abstractions from the contents of adverbial sensory states, it is true if physical objects are our representations of the activity of other monads etc. The basic debate between idealism and physical realism should not be hostage to, and should be possible to conduct prior to and even without, the resolution of internal debates between idealists. What matters, as far as the debate between idealism and its rivals is concerned, is whether the core metaphysical commitment of idealism is fulfilled. I have argued that the modal condition introduced here is the core commitment of idealism, precisely because it fits historical versions of idealism.

Stories about the way physical objects are constructed out of mind-stuff are certainly much needed if idealism is true. But for idealism to *be* true, it is necessary and sufficient that all actual physical objects are ideal in the sense of "ideal" introduced here. Consider this analogy: There are lots of interesting stories that one might want to tell about the natural numbers. But for some entities to *be* the natural numbers, it is necessary and sufficient that they satisfy a few axioms. Similarly, there are lots of interesting stories that one might want to tell about the physical objects if idealism is true. But it is necessary and sufficient for the truth of idealism that *Idealism* be true.

1.2.6 Trivially false?

It might also be objected that idealism is trivially false if *Idealism* is indeed the definition of idealism. Consider a world, Barren, that is a physical duplicate of our world as far planets, nebulae etc. are concerned but does not contain life. Various actual objects exist in Barren without being observable by anyone. Or consider Hidden-α, the world that is much like our world except that in Hidden-α, God is intent to hide Alpha Centauri from us. An actual object exists in Hidden-α without God being disposed to make us observe it. Barren and Hidden-α therefore collectively make *Idealism* false, whether we interpret the latter on the standard or on the theistic definition of ideality. It follows that idealism is easily refuted if *Idealism* is indeed the definition of idealism. Or so one might argue.

In response, the friend of *Idealism* will want to know a bit more about Barren and Hidden-α. How do we know that they contain actual physical objects?

For simplicity and without loss of generality, let's focus on Alpha Centauri, which the objector claims exists in both Barren and Hidden-α. Let's call the actual Alpha Centauri "α" and let's call the Alpha Centauri-like planets in Barren and Hidden-α "Bα" and "Hα," respectively.

The objection at hand is predicated on the claim that α is the same planet as Bα and Hα. Without this premise, the objector cannot conclude that an actual physical object is not ideal.

As far as I can see, there are two ways to establish that α is the same planet as Bα and Hα: by appeal to imagination or by appeal to structure. One can imagine an object that looks like α, and mentally place it in a lifeless cosmos that looks like ours or in a world where God is a bit of a deceiver. Alternatively, one can appeal to some sort of structural description of the planets in question. One can describe α in terms of quarks, electrons, nuclear fusion etc., and attribute the same structure to Bα and Hα.

If we construct Bα and Hα on the basis of imagination, we have no reason to assume that they are identical to α. All we know, on the basis of imagination, is that Bα and Hα look like α. But the fact that two objects look the same does not entail that they are the same object. Presumably, the ideal tree in the quad looks the same as a real tree would. If the ideal tree in the quad did not look the same as a real tree would, then the truth or falsity of idealism would be a perceptual datum. But it isn't. Or, at any rate, it would require a fairly long and strong argument to establish that it is. So imagining a real object that looks like Alpha Centauri does not by itself prove that Alpha Centauri is a real object.

Alternatively, one can construct Bα and Hα through a structural description. For example, one can say that Bα and Hα are constituted by quarks and electrons arranged in the same way as the quarks and electrons in α.

In this case, the idealist will challenge the presupposition that quarks and electrons can exist without subjects. Without this implicit premise, the objection breaks down, because if quarks and electrons happen to be ideal (which cannot be ruled out at this point in the dialectic), then there are no worlds where quarks and electrons compose an unobservable object.

To sum up, the claim that *Idealism* is trivially easy to refute is based on the disjunction of an invalid and a question-begging move. The invalid move consists in the assumption that imagining a possible real object that looks like an actual object guarantees that an actual object is real. The question-begging move consists in the presupposition that the concepts in terms of which one gives a structural description of actual physical objects (such as the concept of quarks and the concept of electrons) are concepts of real physical objects. Since the claim that *Idealism* is trivially false can only be established through one of these moves, *Idealism* is not trivially false.

1.3 Complications

In this section, I look at various counterexamples to the proposed definition of ideality. Most of the counterexamples will involve objects that satisfy some variant of my definition of ideality yet can coherently be conceived as real. My goal will be to refine the definition in various ways until it is immune to all the counterexamples.

For the sake of simplicity, I'll use the following simplified formulation of the definition as my point of departure:

Ideality-0:

O is ideal$_0$ $=_{df}$

$\Box$ O exists $\supset$ someone can observe O

The phrase "can observe" is meant to abbreviate "is observing or would observe (if some exploratory action were performed)." Since the details of this disjunction will be unimportant in the following dialectic, I suppress them.

To see why *Ideality-0* needs fine-tuning, consider the following problems:

Self-observation:

If subjects can observe themselves, then all subjects are ideal$_0$. But the idealist will probably want to say that subjects are real.

Worldbound objects:

If a worldbound object O coexists with subjects who can observe it, then O is by definition ideal$_0$. That sounds wrong. There could very well be worldbound real objects.

Essentiality of origin:

If the causal origins of an object are essential to it, then all observable objects that were caused to exist by subjects and can be observed by subjects are ideal$_0$.

Psychophysical laws:

If the existence of certain organs is sufficient for the existence of subjects who can observe their own organs, then the organs in question are by definition ideal$_0$. But the concept of such organs does not seem to rule out physical realism.

Alien observers:

If God qualifies as an observer, then all objects are ideal$_0$.

These problems indicate that *Ideality-0* is not a precise definition of ideality. It is conceivable that some real objects are ideal$_0$. My goal below will be to keep amending *Ideality-0* until the resulting definition can handle all five of these problems (and some more). But before we get into the complications, let me indicate that, nonetheless, even *Ideality-0* can dispel certain basic worries.

1.3.1 Observation-induced wave function collapse

Suppose one holds an interpretation of quantum mechanics on which the "collapse" of the wave function is a real event induced by observation. We may imagine this phenomenon to be quite radical in the sense that all the physical objects that we know of, down to elementary particles, pop into existence as a result of our observing them. Such interpretations of quantum mechanics are not very popular but neither are they unheard of. Eugene Wigner (1967) argued for a dualist version of QM where immaterial minds collapse the wave function. Albert and Loewer (1988) constructed (without endorsing it) a "many-minds" interpretation which is similarly dualistic. And the physicist David Mermin (1985) has argued that quantum entanglement supports the conclusion that physical objects are "not there" when we don't look.

One could invoke such an interpretation of QM to challenge my definitional strategy the following way: Suppose that the collapse of the wave function is induced by observation. Then, presumably, it follows that physical objects don't exist without there being some subject who observes them. So physical objects appear to satisfy *Ideality-0*. But the theory of observation-induced wave function collapse is not by definition idealistic. It sounds compatible with the claim that physical objects are real (but are caused to exist by immaterial minds).

My response to this worry is that we must make a distinction between the two basic contemporary approaches to the wave function before we start worrying. The two basic approaches are wave function realism and wave function anti-realism (Ney and Albert 2013). On wave function realism, the wave function (or the quantum state that it describes) is a real physical entity or structure, perhaps one that lives in its own special many-dimensional space, which may be distinct from our ordinary 3-dimensional space. On wave function anti-realism, the wave function is merely a fancy description of objects in the 3 (or 3+1) dimensional world that we are acquainted with.

If one is a wave function realist, then observation-induced collapse does not make all physical objects observation-dependent in the sense of *Ideality-0*. Even if macroscopic objects and elementary particles are ideal$_0$ on account of coming into existence as a result of observation-induced wave function collapse, the wave function itself is a physical entity which is there regardless of whether the observers collapse it. So the wave function is not ideal$_0$ if wave function realism is true, hence not all physical entities are ideal$_0$ if wave function realism is true, hence the theory of observation-induced collapse is not classified as a form of idealism by *Ideality-0* if wave function realism is true.

On the other hand, if wave function anti-realism is true, then the theory of observation-induced collapse seems to give us an idealistic ontology. For then there won't be any real "collapse" on observation. If wave function anti-realism is true, then the theory of observation-induced wave function collapse amounts to saying that there are certain probabilities concerning the potential experiences of minds, and the existence of all physical objects reduces to these probabilities. This ontology seems straightforwardly idealistic.

To sum up, the worry that observation-induced collapse poses a threat to my definitional strategy is unmotivated. If wave function realism is true, then even *Ideality-0* can supply the verdict that idealism is false, whereas if wave function anti-realism is true, observation-induced collapse leads to idealism.[10]

1.3.2 Self-observation

If whatever is necessarily observable is ideal_0 and subjects are essentially such that they can observe themselves, then all subjects are ideal_0. Hence, *Ideality-0* cannot capture the notion of ideality that the idealist needs, because the idealist hardly wants to be committed to the thesis that either no subject is real or subjects are not essentially capable of self-observation.

I propose to solve these problems by making the following improvement:

Ideality-1:

O is $\text{ideal}_1 =_{df}$

$\Box$ O exists $\supset$ O can be observed by some S such that $S \neq O$

Subjects are not distinct from themselves, so self-observation does not make them ideal_1. Subject are only ideal_1 if they are observable by others in all worlds where they exist.

This tweak is not *ad hoc*. Intuitively, idealism concerns the relation of immaterial subjects to physical objects, and immaterial subjects are guaranteed not to be identical to physical objects. So self-observation is not relevant here. *Ideality-1* is an admissible improvement when it comes to defining the notion of ideality that the idealist is after.

1.3.3 Worldbound objects

Let's take a worldbound real physical object that happens to be such that it is always observed by someone. Maybe the object in question is very important. Maybe it is the Big Red Button that can unleash the nuclear winter. Let's call it "Big." We are assuming that Big is (i) worldbound, (ii) real, and (iii) observed by someone or other during the whole of its existence.

Being worldbound, Big doesn't exist in any other world and being a very important object, Big is always observed by someone in our world. Moreover, Big is clearly not distinct from its observers (who are humans). It follows that, for all worlds W, Big exists in W only if Big is observed by beings distinct from Big, which makes Big ideal_1. But we have assumed that Big was real, and the

[10] Thanks to Barry Dainton for raising this problem.

hypothesis that Big is real seems compatible with the rest of the scenario. Consequently, it is conceivable that some ideal$_1$ objects are real, so *Ideality-1* cannot be the definition of ideality.

I propose to solve this problem by the following upgrade:

Ideality-2:

O is ideal$_2$ $=_{df}$

□ For any intrinsic duplicate dO of O, dO can be observed by some S such that $S \neq dO$

By saying that x is an intrinsic duplicate of y, I mean that x and y have the same intrinsic structure. For example, an intrinsic duplicate of Big would be a possible big red button with the same dimensions, same physical composition etc. All intrinsic duplicates of Big are big, red, and button-shaped. If Big is composed of real elementary particles, then all intrinsic duplicates of Big are composed of the same type of real elementary particles, arranged in the same configuration. But not all intrinsic duplicates of Big are in the same kind of environment and not all of them are connected to a nuclear missile control center. Generally, an intrinsic duplicate of y is a possible entity which is exactly like y in terms of its internal structure but may differ from y in its relational properties.

The concept of ideality$_2$ solves the problem of worldbound objects. Even if Big is worldbound, always observable, and hence ideal$_1$, some of its intrinsic duplicates may fail to coexist with subjects if Big is real. Perhaps in a world similar to ours, an intrinsic duplicate of Big is pushed, life is destroyed forever in the nuclear winter, but Duplicate Big is spared and nobody ever looks at it again. If Big is a real object, such scenarios are certainly possible. So if Big is real, then Big will not qualify as ideal$_2$, thanks to Duplicate Big.

Alternatively, if Big is, say, a worldbound collection of red sense data, then Big will be classified as ideal$_2$ as long as all of its intrinsic duplicates are observed by someone, which is only to be expected if Big is a collection of sense data. So *Ideality-2* solves the problem of worldbound objects.

It might be objected that *Ideality-2* is hard to apply to some of the historical ontologies discussed in 1.2.1. Suppose that the existence of Big reduces to facts about potential experience or to facts about divine archetypes. What is an intrinsic duplicate of Big in those cases? I reply that in such cases, intrinsic duplication involves the duplication of the relevant reductive base. For example, if Big is a worldbound ideal button the existence of which reduces to the existence of some archetype A in God's mind, then a duplicate of Big exists in W iff God has a duplicate of A in His mind in W.

1.3.4 Disappearing real objects

Ideality-2 also solves the following puzzle. Imagine a world where physical objects are real but the laws of nature are such that physical objects disappear when people are not near. As subjects walk around these worlds, objects keep appearing around them, and then pop out of existence when subjects are at a safe distance. Physical objects in this world only exist when subjects can observe them, yet they can be coherently assumed to be real.

Ideality-2 solves this puzzle because if the objects in question are indeed real, and hence not constructed out of nonphysical mind-stuff or otherwise essentially tied to mentality, then it is safe to assume that intrinsic duplicates of them exist in worlds where the laws of nature do not make their generation and destruction a function of their extrinsic relations to subjects. So these disappearing real objects are not ideal$_2$.

1.3.5 Essentiality of origin

Ideality-2 can defuse another type of puzzle. Suppose that the causal origins of objects are essential to their identity and minds bring certain physical objects into existence in all nomologically accessible worlds. For example, imagine a dualist ontology where psychophysical laws guarantee that all human minds bring a real pineal gland into existence during their gestation in the womb. If origins are essential, these pineal glands will necessarily coexist with subjects. If subjects (who, remember, are assumed to be immaterial) can observe their own pineal glands, then pineal glands will qualify as ideal$_1$, even though they are real by hypothesis. But they will not qualify as ideal$_2$ if some of their intrinsic duplicates fail to coexist with minds. (E.g. because zombies are possible.)

However, *Ideality-2* gives the wrong verdict if we switch to physicalism. Suppose that subjects are (real) physical entities which all come with a pineal gland attached, and the latter, in turn, cannot exist without being part of a subject. In other words, the existence of (real) pineal glands is sufficient for the existence of certain types of subjects. Pineal glands will then qualify as ideal$_2$ (provided that the subjects in question can observe their own organs, which is conceivable). So some real objects can be ideal$_2$ after all—*Ideality-2* is not the definition of ideality either. Note, however, that this isn't a problem about the essentiality of origins any more. It is a problem about psychophysical laws that make the existence of certain organs sufficient for the existence of subjects. Let's see how ideality$_2$ can be tweaked to handle this phenomenon.

1.3.6 Psychophysical laws

The problem of psychophysical laws arises if the existence of certain physical organs is sufficient for the existence of subjects. Coupled with the assumption that subjects can observe their own organs, such organs will qualify as ideal$_2$. But the existence of psychophysical laws is compatible with realism. So *Ideality-2* is not the definition of ideality.

I propose to solve this issue using the following complex concept:

<u>*Decomposition*</u>

{ $p_O^{\,1}$, $p_O^{\,2}$,...} is a decomposition of $O =_{df}$
The members of { $p_O^{\,1}$, $p_O^{\,2}$,...} are mereologically distinct, each one of them is a part of *O*, and their fusion is *O*.

<u>*Ideality-3*</u>*:*

O is ideal$_3$ $=_{df}$ $\Box$ For any decomposition { $p_O^{\,1}$, $p_O^{\,2}$,...} of *O* there is a $p_O^{\,i}$ in { $p_O^{\,1}$, $p_O^{\,2}$,...} such that: $\Box$ For every intrinsic duplicate $dp_O^{\,i}$ of $p_O^{\,i}$, $dp_O^{\,i}$ can be observed by some *S* such that $S \neq dp_O^{\,i}$
≡ $\Box$ Any decomposition of *O* has an ideal$_2$ member.

Despite the abundance of mereological concepts, *Ideality-3* is meant to be neutral on the metaphysics of parthood. The concept can be reformulated under mereological nihilism without any significant change, as far as the problem-solving power of *Ideality-3* is concerned. Suppose that "Renée's pineal gland" is a plural referring term that picks out some particles. The nihilist version of *Decomposition* will identify { $p_O^{\,1}$, $p_O^{\,2}$,...} as the set of particles in question, and the nihilist version of *Ideality-3* will say that Renée's pineal gland is an ideal$_3$ plurality iff for any such { $p_O^{\,1}$, $p_O^{\,2}$,...}, some $p_O^{\,i}$ is such that all of its intrinsic duplicates are observable by a distinct subject. The idea behind *Ideality-3* is neutral on the metaphysics of parthood. We could just as well talk about organwise arranged particles instead of organs without any change in the way of *Ideality-3* defuses the puzzles at hand. With this proviso in mind, I'll continue to use the idiom of parthood, because it is very convenient.

The gist of *Ideality-3* is that ideal$_3$ objects cannot be decomposed into parts each of which has an unobservable intrinsic duplicate. Real pineal glands are not ideal$_3$ if they are composed of parts that have unobservable intrinsic duplicates, which is a reasonable assumption under standard physical realism, on which pineal glands are composed of quarks and electrons, which, in turn, can exist in the absence of subjects.

1.3.7 Humean bundles

The problem with *Ideality-0*, *Ideality-1*, and *Ideality-2* was that they misclassify some conceivable real physical objects as ideal. The problem with *Ideality-3* is that it misclassifies some conceivable real nonphysical objects as ideal. To see why, suppose that the idealist is (sensibly) committed to the thesis that subjects are real but she also thinks that subjects are Humean bundles of (nonphysical) sense data. Let David be such a bundle, and let { $s_D^{\,1}$, $s_D^{\,2}$,...} be the set of sense data that compose David. { $s_D^{\,1}$, $s_D^{\,2}$,...} is a decomposition of David in the sense just introduced. If dense data are essentially observable (indeed, observed) by something that isn't identical to them, which is a reasonable assumption and can be added to the theory we're discussing without the threat of incoherence in any case, it follows that all actual decompositions of David have ideal$_2$ members. This reasoning can be repeated for any possible bundle that can constitute David, so David is ideal$_3$. But we supposed that David is a real nonphysical mind.

I propose to solve this problem with the following upgrade:

Weak Distinctness

x and y are weakly distinct $=_{df}$
x is not part of y and y is not part of x

Ideality-4:

O is ideal$_4$ $=_{df}$ $\Box$ For every decomposition $\{ p_O{}^1, p_O{}^2,...\}$ of O,
for some $p_O{}^i$ in $\{ p_O{}^1, p_O{}^2,...\}$: $\Box$ For every intrinsic
duplicate $dp_O{}^i$ of $p_O{}^i$, $dp_O{}^i$ can be observed by some S
such that S and $dp_O{}^i$ are weakly distinct.

Ideality-4 is the same as *Ideality-3* except that it requires that the subjects that can observe the parts of O be weakly distinct and not simply nonidentical.

Ideality-4 solves the problem of Humean bundles because the parts of David are not weakly distinct from David. So David is not ideal$_4$.

At the same time, *Ideality-4* can deliver the same results that *Ideality-3* was meant to solve, so it is not a stepback. For suppose that Renée the immaterial mind only exists if his real pineal gland does. Since Renée's pineal gland can be decomposed into particles intrinsic duplicates of which can exist without being observable by anything, Renée's real pineal gland is not ideal$_4$.

It might be objected that *Ideality-4* nonetheless gets into trouble in the Humean idealist context if the Humean idealist treats physical objects as collections of sense data. For then the same reasoning that tells us that David is not ideal$_4$ tells us that David's wig (a collection of David's and other people's sense data) is not ideal$_4$ either. My response to this worry is to add to *Decomposition* the proviso that physical objects are to be decomposed into physical parts and nonphysical objects are to be decomposed into nonphysical parts. (In Nihilese: the terms that pick out putative complex nonphysical objects plurally refer to nonphysical simples and the terms that pick out putative complex physical objects plurally refer to physical simples.) Since the physical parts of David's wig are not sense data, David's wig will not qualify as ideal$_4$. The substantive intuition behind this proviso is that the sparse idealist who identifies both physical objects and minds with bundles of sense data should introduce two different bundling relations, only one of which (if any) corresponds to parthood. Parts of physical objects should be construed as themselves public and hence physical, so sense data are not parts of physical objects even if physical objects are bundles of sense data.

1.3.8 Thoroughly psychofunctional matter

Ideality-4 can solve another puzzle that ruins *Ideality-3*. Imagine a world where physical objects are real, pineal glands are nomologically sufficient for the existence of subjects, pineal glands are physical simples, and subjects are physical organisms who can observe their own pineal glands. *Ideality-3* delivers the verdict that pineal glands are ideal$_3$. But we presupposed that they are real. So some conceivable real objects are ideal$_3$.

Let's introduce the following concept to investigate this puzzle:

Thoroughly Psychofunctional Matter:

A piece of matter M is thoroughly psychofunctional $=_{df}$

$\Box$ For any part p_M of M: $\Box$ For any intrinsic duplicate dp_M of p_M, dp_M is a proper part of some S such that S can observe dp_M.

Thoroughly psychofunctional matter is composed of parts which have no unobservable intrinsic duplicates, because all the duplicates come with a subject attached. The mereologically simple pineal glands introduced above are pieces of thoroughly psychofunctional matter. Thoroughly psychofunctional matter is matter that is organic through and through, so that the existence of any part of it is sufficient for the existence of a whole organism. Everything made of such matter qualifies as ideal$_3$, even though such matter might be real. *Ideality-4* solves this problem, because subjects made out of thoroughly psychofunctional matter are not weakly distinct from their body parts so *Ideality-4* is not satisfied.

A devious interlocutor might worry that *Ideality-4* nonetheless gets into trouble when it comes to thoroughly psychofunctional *dualistic* matter. Suppose that minds are nonphysical simples that have bodies composed of parts each of which is sufficient for the existence of a subject. These body parts will be distinct (and hence weakly distinct) from the subjects themselves, because the latter are nonphysical simples. If we continue to assume that subjects can observe their own body parts, their body parts are necessarily observable by some subject that is weakly distinct from them. So anything made of thoroughly psychofunctional dualistic matter is ideal$_4$. But we presupposed dualism, so these material objects should qualify as real.

My reply is to deny that thoroughly psychofunctional dualistic matter is possible. I don't deny that in some world, noonphysical simples are nomically correlated with bodies made of strange matter no part of which can (under that specific nomic regime) exist without being accompanied by a nonphysical mind. But I maintain that as long as we take this to be a truly dualistic scenario, then even if minds are always accompanied by hunks of this strange type of matter in one specific nomic regime, these extrinsic relations between the minds and their bodies are not definitive of what these minds *are*, and likewise for the bodies in question. Hence, some intrinsic duplicates of these minds exist in worlds without such bodies and intrinsic duplicates of their bodies exist in worlds where they are not extrinsically correlated with immaterial minds. So the bodies in question are not ideal$_4$, because some of their intrinsic duplicates (namely, the ones that are physically the same but are not nomically correlated with nonphysical simples) exist without being observable by anyone weakly distinct from them.[11]

1.3.9 Alien observers

One can trivialize *Ideality-4* by assuming that God can observe everything in all worlds. If this is true, then all entities are by definition ideal$_4$ (except for God), because all possible intrinsic duplicates of all parts of all objects are observable by a subject weakly distinct from them. So *Ideality-4* collapses if God qualifies as an observer. (More precisely, *Ideality-4* collapses if God is an observer who is weakly distinct from created entities.)

To construct a similar puzzle without theism, suppose that somewhere in the far reaches of our galaxy, there lurks a demon, the Grand Intuitor, who can observe any of his worldmates with his extremely powerful demonic mind. The Grand Intuitor has this capability essentially. And he is such a persistent being that he exists in all worlds that contain a duplicate of an actual physical object. All duplicates of all actual physical objects are located in worlds where the Grand Intuitor, a being distinct (and so weakly distinct) from them, can observe them. So all actual physical objects ideal$_4$. But it seems coherent to suppose that the Grand Intuitor lives in physical realist worlds.

I propose to solve such problems by restricting the meaning of “observe” in *Ideality-4* to acts of observation that we humans (or actual organisms in general) are capable of. Neither God nor the Grand Intuitor observes anything in that sense. Their ways of perceiving are alien. This restriction is not *ad hoc*. Neither God nor the Grand Intuitor observe through sight, touch, smell etc. “Observe” is not univocal if we mix talk of alien observation with talk of human observation.

[11] A further similar devious puzzle. Suppose that Romeo and Juliet are real, metaphysically simple immaterial minds who necessarily coexist and can always observe each other, because they cannot possibly tolerate each other’s absence. Since they are nonetheless distinct (and so weakly distinct), it follows that necessarily, both can be observed by an entity that is weakly distinct from it: Romeo by Juliet and Juliet by Romeo. So both of them are ideal$_4$. (Note that this does not follow if Romeo and Juliet are not simple.) But we have presupposed that they are real. Trouble. My response to this puzzle is the same as my response to the case of thoroughly psychofunctional *dualistic* matter: I deny the intuition that Romeo and Juliet are real in this setup. In this setup, Romeo and Juliet are such that it is nomically impossible for them, in every possible nomic regime, not to coexist. To my mind, this implies that the entity that is Romeo cannot function as Romeo, and hence cannot *be* Romeo, without coexisting with Juliet. This suggests that Romeo is just an ideal part of a larger complex real entity, namely the couple Romeo+Juliet. Note that *Ideality-4* readily delivers the verdict that the couple Romeo+Juliet is not ideal$_4$, because (assuming that Romeo and Juliet are separable from external observers), it is false that Romeo+Juliet is necessarily observable by something weakly distinct from it: it is necessarily observable only by its proper parts, who are not weakly distinct from it. Generally, cases analogous to Romeo and Juliet’s are, in my view, cases where only intersubjective structures are real without individual subjects being real.

1.3.10 Summary of 1.3.2–1.3.9

Here's a quick overview of the preceding dialectic. I began with the following simple definition of ideality:

<u>*Ideality-0*</u>*:*

$$O \text{ is ideal}_0 =_{df} \Box\, O \text{ exists} \supset \text{someone can observe } O$$

There are five basic problems with *Ideality-0*. First, assuming that subjects can observe themselves, all subjects are ideal_0. Second, worldbound objects that coexist with subjects who can always observe them are ideal_0. Third, if origins are essential, then any object brought into being by subjects who can observe it throughout its existence is ideal_0. Fourth, biological organs the existence of which is sufficient for the existence of subjects are ideal_0. Fifth, if God qualifies as an observer, then everything is ideal_0. So *Ideality-0* cannot define ideality—it is conceivable that some real objects are ideal_0.

I introduced four tweaks. *Ideality-1* defined ideal objects as objects that are necessarily observable by a subject distinct from them (1.3.2). This takes care of the problem of self-observation. I argued that this fix is not *ad hoc* because idealism is meant to be a thesis about the relation of subjects to objects that are distinct from them and not a thesis about the relation of subjects to themselves.

Ideality-2 defined ideality in terms of intrinsic duplicates: ideal_2 objects are such that all their intrinsic duplicates can be observed by a subject distinct from them. *Ideality-2* can defuse the puzzle about worldbound objects, because even if a real worldbound object (for example, a worldbound big red button) happens to be accompanied by subjects all the time, it is to be expected then some of its intrinsic duplicates will fail to coexist with subjects if the object in question is real (1.3.2). *Ideality-2* can also defuse a puzzle concerning the essentiality of origin (1.3.3) and a puzzle about disappearing objects (1.3.4).

Ideality-3 defined ideal objects as objects that can be decomposed into ideal_2 parts. *Ideality-3* can defuse a puzzle concerning psychophysical laws (1.3.5).

Ideality-4 defined ideal objects as objects that can be decomposed into objects whose intrinsic duplicates are necessarily observable by a subject that is not part of them nor contains them (i.e. is weakly distinct from them). This concept solves a problem about nonphysical real subjects conceived as Humean bundles (1.3.7) and a problem about thoroughly psychofunctional matter (1.3.8).

Finally, I argued that *Ideality-4* is not threatened by alien observers like God or the Grand Intuitor (a demon who can observe all possible duplicates of all actual physical objects, thanks to his alien mental powers). We can restrict the meaning of "observation" in *Ideality-4* to acts that we humans are capable of, because idealism is meant to be a thesis about the way that physical objects are dependent on our sorts of perceptual and cognitive activity. Neither God nor beings like the Grand Intuitor qualify as observers in that sense.

1.3.11 The official definition

The fine-tuned definition that emerges from the preceding dialectic is rather complicated, especially if one takes notice of the theistic alternative that was discussed in 1.2.2 but was put aside for the sake of simplicity. In any case, here is the full official definition:

<u>*Exists for*</u>

x exists for *y* $\equiv$ *y* can observe *x*

<u>*Observability*</u>

y can observe *x* $\equiv$ *y* is observing *x* or *x* would observe *x* if
y performed some exploratory action

<u>*Decomposition*</u>

{ p_O^1, p_O^2,...} is a decomposition of $O =_{df}$
The members of { p_O^1, p_O^2,...} don't overlap,
each of them is a part of *O*, their fusion is *O*, and
they are physical entities iff *O* is a physical entity.

<u>*Weak Distinctness*</u>

x and *y* are weakly distinct $=_{df}$
x is not part of *y* and *y* is not part of *x*

<u>*In itself*</u>

x exists in itself $=_{df}$
(*a*) (standard version)
x does not exist for some *y* that is weakly distinct from *x*
(*b*) (theistic version)
God is not causing and is not disposed to cause
created subjects to observe *x*

<u>*Ideality*</u>*:*

O is ideal $=_{df}$
$\Box$ In every decomposition { p_O^1, p_O^2,...} of *O*, there is some p_O^i
such that: $\Box$ No intrinsic duplicate of p_O^i exists in itself.

<u>*Reality*</u>*:*

O is real $=_{df}$
$\Box$ For all p_O^i in some decomposition { p_O^1, p_O^2,...} of *O*:
$\Diamond$ An intrinsic duplicate of p_O^i exists in itself.

<u>*Idealism*</u>

All actual physical objects are ideal.

These definitions form the basis of my official analysis of idealism as the claim that physical objects are ideal. Although the following chapters will use the simple original definition to reduce clutter, a counterexample-proof version is available when push comes to shove.

1.3.12 P.S. Idealism about abstracta

Ideality is meant to be a definition of ideal *concrete* objects. It cannot be applied to abstract objects, because it sounds wrong to say that numbers or propositions are, or could be, observed. But perhaps there are relevant analogous concepts of ideality and reality for the abstract realm.

One might try to transfer *Ideality* to abstracta by replacing "observe" with something like "think of." The claim, in its most basic form, would then be that ideal abstracta are abstracta that only exist in worlds where someone can think of them. This idea is open to an analogue of the problem of alien observers—in this case, there will be a problem about alien thinkers who necessarily coexist with, and can think of, any abstract object. For example, God will render all abstract objects ideal. There will be analogous problems about worldbound abstracta etc. Let's pretend that we have introduced appropriate fixes for these problems by stipulating that "think of" refers to human thinking etc. For simplicity, let me use the slogan that an abstract object is ideal iff it only exists in worlds where humans can think of it.

This definition will entail that all necessary abstracta are real (provided that there are possible worlds without humans, which sounds plausible). So numbers and propositions will qualify as real. If one conceives of physical laws as propositions, then the definition will also allow the idealist to say that physical objects are not real but physical laws are real.

The definition can also ground a distinction between necessary abstracta like numbers or propositions and abstract artifacts like novels or symphonies. The former will qualify as real abstracta and the latter may qualify as ideal abstracta. Novels and symphonies will qualify as ideal abstracta if they only exist in worlds where people can read novels and listen to symphonies. Since numbers and propositions seem to be very different from novels and symphonies *qua* abstracta, this feature of the definition in question might be sensible.

I emphasize that a commitment to *Idealism* is not meant to be a commitment to idealism about abstracta. Exploring the concept of idealism about abstracta would need a whole other dissertation. I'm only mentioning this theory to set it aside. Idealism about abstracta would be the thesis that all abstract objects necessarily coexist with humans who can think of them. This theory seems to be a form of nominalism, and it is very different from idealism about physical objects. Even if it might be historically linked to idealism (e.g. by way of Berkeley's criticism of abstract ideas), the two theories do not entail each other. *Idealism* is not applicable to abstract objects and it seems logically compatible with realism about abstracta, just as idealism about abstracta seems logically compatible with realism about physical objects.

1.4 The problem of grounding

Recently, concepts of fundamentality, dependence, and grounding have become prominent in metaphysics (Correia and Schnieder 2012, Fine 2001, Lowe 1998: Ch.6, Schaffer 2009 etc.). For the purposes of introduction, I'll use "grounding" as an umbrella term to cover these concepts. The goal of this section is to find out whether theories of grounding can challenge my definition of idealism.

Grounding is said to be a phenomenon that is of central importance for nearly all areas of metaphysics, the phenomenon that underlies composition, realization, and determination, among other things. It is said to supersede supervenience in the analysis of dependence and modal notions in the analysis of essence. Friends of grounding routinely recommend that we recast familiar claims about the supervenience of the mental on the physical, or of the moral on the nonmoral, or of truth on being, or of wholes on parts, as claims like

(G1) The mental is grounded in the physical.

(G2) The moral is grounded in the nonmoral.

(G3) Truth is grounded in being.

(G4) The properties of the whole are grounded in the properties of the parts.

If friends of grounding are right, then my proposed definition of idealism may be on the wrong track, because my proposed definition is built on modal notions and does not use the idiom of grounding. But if grounding supersedes modal analyses of dependence and essence, then idealism should probably be formulated as the following thesis:

(G5) The physical is grounded in the mental.

The goal of this section is to find out whether we have warrant for thinking that (G5), or some similar thesis that uses the concept of grounding, priority, dependence, or fundamentality, is indeed preferable to my proposed definition, *Idealism*, which does not use any of those concepts.

The chief problem about grounding, and the reason why I am staying clear of this concept in my official analysis of idealism, is that the basic substantive and logical features of grounding are alarmingly unclear. The concept of grounding is often said to be an undefinable primitive, but there are a number of putative primitives floating around in the literature, all reminiscent of, and possibly competing with, each other, but differing in details. Schaffer (2009) introduces a primitive relation between entities, called "grounding." Bennett (2011) argues for a different primitive relation called "building." Fine (2001) opts for a primitive notion of *essence* and a primitive notion of *real propositions*. Lowe (1998: Ch.6) frames claims reminiscent of (G1)–(G5) in terms of *ontological dependence*, which is a cross-categorical relation. Which one should one choose?

The situation is even more bewildering on the logical side, even if we restrict our attention to a single putative primitive. Grounding is an irreflexive, transitive, and asymmetric relation according to Correia (2010), Fine (2010), Raven (2013), and Schaffer (2009). It is not transitive according to Audi (2012), Rosen (2010), and Schaffer (2012). It is not irreflexive according to Correia (2014) and it is not irreflexive, not asymmetric, and not transitive according to Rodriguez-Pereyra (2015). It is hard to engage with the concept of grounding outside its own cottage industry while experts are still debating its most basic logic features.

My strategy will be the following: I'll present three classic criteria (two formal and one substantive) that have been used to characterize the phenomenon of grounding (understood as a relation between entities). Next, I'll check if the relation obtaining between subjects and physical objects under *Idealism* meets any of the criteria. I'll argue that it meets all three, so there is no good reason to think that *Idealism* is not the definition of a grounding relation *if* we assume that the three criteria in question indeed characterize grounding. Since I can't engage with the grounding literature as a whole here, I'll assume that this is enough to raise doubts about whether the theory of grounding is a real challenge to my own approach to defining idealism.

Jonathan Schaffer (2009), one of the main champions of grounding, offers the following brief characteristic of the relation question:

(C1) <u>Asymmetry</u>. Grounding is asymmetric: If x grounds y, then x doesn't ground y.

(C2) <u>Hyperintensionality</u>. For some x, y, and z, x grounds y but x does not ground z even though y and z necessarily coexist (or are necessarily coinstantiated, or have the same truth value in all worlds etc.).

(C3) <u>Explanatory relevance</u>. *That x grounds y* explains, or helps explain, something about the metaphysics of y. If x grounds y, then y exists in virtue of x and/or the nature of y is determined by x etc.

These criteria are often used to dismiss supervenience-based analyses of (G1)–(G5), on the grounds that supervenience fails to satisfy (C1) and (C2), hence it cannot be the same as grounding.[12]

To see whether *Ideality* satisfies (C1)–(C3), let's remind ourselves of the basic content of my proposed definition of idealism:

<u>*Idealism*</u>*:*

All actual physical objects are is ideal $\approx_{df}$
For any actual physical object O, $\Box$ O exists $\supset$
$\supset$ O is observed or is observable by a subject.

[12] McLaughlin and Bennett (2011: 3.5), Fine (2001: 11, 15), Schaffer (2009: 364).

Let's say that φ is the relation that obtains between subjects and any specific physical object *O* if *Idealism* is true:

(10) subjects φ *O* ≡
$\Box$ *O* exists ⊃ *O* is observed or is observable by a subject

The question is whether φ is a grounding relation. If it is, then the charge that *Idealism* should be replaced by a claim about grounding is not very well motivated, because *Idealism* then *is* a claim about grounding.

We know that φ isn't a grounding relation if φ does not satisfy one of the three main criteria of grounding, (C1)–(C3). Conversely, we have reason to doubt that φ isn't a grounding relation if φ satisfies all of (C1)–(C3).

Apparently, φ satisfies (C1), the criterion of asymmetry. If we switch the terms in (10), substituting "physical objects" for *O*, we get

(11) Physical objects φ subjects ≡ $\Box$ a subject *S* exists ⊃
S is observed or is observable by a physical object

Since subjects are not physical objects in idealist worlds, physical objects cannot observe anything in idealist worlds, hence (11) is false in the context of idealism. Consequently, φ is asymmetric in the context of idealism.

For φ to satisfy the hyperintensionality condition, (C2), there must be some *x* and *y* such that (i) *x* and *y* necessarily coexist, and (ii) subjects φ *x* but they do not φ *y*. Arguably, φ satisfies this condition, so φ is a hyperintensional relation. For consider the following three entities:

S_N : Socrates's nose
$\{S_N\}$: the singleton of Socrates's nose
$[S_N]$: the fact that Socrates's nose exists

These entities necessarily coexist. If idealism is true, then noses are ideal objects, so the following will be true:

(12) subjects φ S_N ≡ $\Box$ Socrates's nose exists only if
subjects can observe it.

But the following propositions will be false:

(13) subjects φ $\{S_N\}$ ≡ $\Box$ The singleton of Socrates's nose exists
only if subjects can observe it.

(14) subjects φ $[S_N]$ ≡ $\Box$ The fact that Socrates's nose exists exists
only if subjects can observe it.

These proposition are false because sets and facts cannot be observed. They are objects of thought, not objects that impact our senses. Or, at any rate, there seems to be a coherent conception of observation on which sets, facts, numbers, propositions etc. cannot be observed, and the idealist is free to adopt that conception, making φ hyperintensional.

The third question is whether the fact that subjects φ physical objects explains what physical objects are. It seems that φ does have explanatory relevance in this sense. Specifically, (10) suggests that the existence of ideal physical objects is essentially related to actions through which subjects explore their environment. So it is reasonable to say that φ explains something about the nature of ideal physical objects.

To sum up, the relation that forms of the basis of *Idealism* satisfies the basic formal and substantive criteria of grounding.

This result can be interpreted in two ways. First, it can be interpreted as a sign that φ is a grounding relation. Then the complaint that *Idealism* should be replaced by a grounding claim is unmotivated. Alternatively, the result can be interpreted as a sign that (C1)–(C3) do not characterize grounding. Then friends of grounding must look for other criteria to distinguish true grounding claims from modal analyses like *Idealism*. Pending any persuasive suggestions about such criteria, I conclude that *Idealism* could very well be the definition of the grounding relation that obtains between subjects and physical objects in idealist worlds. Hence, the complaint that *Idealism* should be replaced by a grounding claim is unmotivated.

1.5 Summary of Chapter 1

Chapter 1 offered, refined, and defended a modal definition of idealism. In 1.1, I claimed that extant formulations of idealism do not meet the basic criterion that a definiens should be better understood than the definiendum. I considered seven extant formulations of idealism and I argued that they all fail this test.

Section 1.2 introduced a modal definition of idealism. The definition says that idealism is true iff actual physical objects are ideal, with ideal objects defined as objects the existence of which presupposes the existence of subjects who can observe the objects in question. I argued that this condition meets the basic criterion for being a definition (1.2.1). I also argued that if we take a theistic variant into account, the definiens is entailed by four historical forms of idealism, so we have reason to think that the definiens is a necessary condition of idealism (1.2.2). I also argued that the proposed definiens entails the falsity of physical realism, hence it is a sufficient condition of idealism (1.2.3). Finally, I defended the definition from the charge that it is too thin (1.2.4) and that it makes idealism trivially easy to refute (1.2.5).

Section 1.3 refined the definition of ideality by engaging with a series of puzzles about possible objects that can be coherently conceived as real yet are classified as ideal by one of my definitions of ideality. By the end of 1.3, I constructed a fine-tuned definition that is wholly in the spirit of the original and is immune to the counterexamples.

Section 1.4 confronted the objection that idealism should be formulated as a thesis about grounding and not in terms of modal conditions. I argued that the literature on grounding is very confusing, then I showed that the definiens meets the three known conditions featured in one prominent conception of grounding relations, so the complaint that my definition should be replaced by claim about grounding is not very well motivated.

The take-home message of Chapter 1 is the collection of three shorthand definitions that will be used in later chapters to argue for idealism:

Ideality (standard version):

O is ideal $\approx_{df}$

$\Box$ O exists $\supset$ O is observed or is observable by someone

Ideality (theistic version):

O is ideal $\approx_{df}$

$\Box$ O exists $\supset$ God is causing or is disposed to cause subjects to observe O.

Ideal properties:

Physical property P is ideal $\approx_{df}$

$\Box$ $\forall x$: x is P $\supset$ Someone observes or could observe that x is P.

2 The ideality of matter and space: Three contemporary arguments

This chapter reconstructs three contemporary arguments for idealism and uses the resulting dialectic to lay the foundations for the idealist argument that the dissertation ultimately defends.

Section 2.1 deals with Howard Robinson's case for idealism, which falls into two parts. The first part, called "the Power Regress," seeks to show that worlds without categorical properties are metaphysically impossible (2.1). I'll argue for a new variant of Robinson's original Power Regress, "the epistemic Power Regress," which aims to show that physical realism is false if all physical properties are dispositions. The second phase of Robinson's case for idealism is a refutation of physical realism from the conjunction of the Power Regress with the thesis that every fundamental physical property is a disposition (2.2). I'll argue that fundamental physical properties are indeed typically dispositions, or, at any rate, they lend themselves very easily to a dispositionalist interpretation (2.2.2). But Robinson's case for idealism is vulnerable to the objection that spatiotemporal position is not a dispositional property (2.2.3).

Section 2.3 reconstructs two arguments by John Foster against the reality of spacetime. Foster's *modal* argument seeks to show that the physical realist must be commited to two contradictory claims, the claim that physical space could have sustained different laws and the claim that it could not have (2.3.1). Foster's *abductive* argument attempts to prove that the physically relevant structure of spacetime is the structure manifest in experience, hence, by inference to the best explanation, real physical space can be thrown out of our ontology (2.3.2). I'll claim that both of these arguments are eminently defensible and physical realists can only resist them either by embracing some implausible metaphysical principle (e.g. that the laws of nature are metaphysically necessary) or by showing that we have good reasons, independently of the ontology of spacetime, to prefer physical realism to idealism.

2.1 The Power Regress

2.1.1 Robinson's version of the Power Regress

Consider a billiard ball, Bill, and an empty region of space, Reggie. Suppose that Reggie has the same shape and size as Bill. What's the difference between Bill and Reggie? What properties does Bill have that Reggie fails to have?

The intuitive answer is that Bill fills space whereas Reggie *is* space. Bill has mass, which is spread out in a certain region. Bill can move to other regions. Reggie lacks mass, and Reggie cannot move to other regions because Reggie *is* a region. So having mass and having a spacetime trajectory seem to be the two main properties that set Bill apart from Reggie. Since having a trajectory is an extrinsic feature of Bill's, we must examine mass if we want to know what intrinsic feature makes Bill into a real physical object.

Mass, as it figures in classical physics, determines how an object moves and how it influences the movement of other objects. The heavier an object is, the more reluctant it is to be accelerated by outside forces and the greater its gravitational pull on other objects. (Mass is a much more complicated property in modern physics, but we may ignore this for the sake of illustration.) So, all in all, what we have is that the only intrinsic property that makes Bill into a real object is a property that tells us what Bill does under various circumstances.

The gist of Robinson's argument for idealism is that such power-like properties cannot exhaust the nature of an object, so physical realism is false. This argument involves two central claims: (i) there must be physical properties that are not powers if physical realism is true and (ii) all physical properties are powers. Here is the argument for (i), which takes the form of a regress:

> We only know what [a power] *A* is if we know what kinds of thing the actualization of its potentiality gives rise to […], what it is a power to do, what states would constitute its manifestation. Let us call the power which *A* is the power to produce "*B*." So what *A* is, is the power to produce *B*. But this is not informative unless we know the nature of *B*. *B*, being a power, is the power to produce some further power state, call it *C*. […] It seems that we are moving in a regress. […] And though I have stated this argument in terms of what we could know, the argument is not essentially epistemological. One could equally well say that what the nature of *A* is depends on what it is a potentiality for, for what a power is, is given by what it is a power to do. What it is a power to do is a function of what would constitute its manifestation, and if the nature of this latter can have no determinate expression, neither can the power which is determined in terms of it.
>
> (Robinson 2009: 192, cf. Robinson 1982: 113–7)

One might try to justify this argument ("the Power Regress," as I'll call it) the following way. Dispositions (or powers—I'll use these terms interchangeably) are often characterized as "pointing" toward their manifestations. Fragility points toward breaking, negative charge points toward attracting positively charged objects etc. If a disposition *D* had another disposition *E* for its manifestation, *D* would point toward a pointing. It seems sensible to suggest that *D* would then ultimately point toward the state that *E* points toward, and that state would constitute *D*'s true manifestation, with *E* being a mere mediator. Even if *D* points toward another disposition *E*, what bearers of *D do* (how they can change things or can be changed) is determined by the state that *E* points to. *D* ultimately points to whatever *E* points to, in other words, dispositions only mediate the manifestations of other dispositions without constituting their manifestations. But then we get into a vicious regress if we assume that every disposition points toward another disposition.

To milk this intuition, consider the world Vim. Vim has the following stock of fundamental properties: *type 1 vim*, *type 2 vim* etc. And suppose that *having type N vim* is the disposition to make a neighbouring object have type *N*+1 vim. Every fundamental property in Vim is a disposition to bestow a disposition to bestow a disposition… *ad infinitum*. Vim is a world without categorical features. Proponents of the Power Regress believe that such worlds are metaphysically empty, because they only contain dispositions that mediate further dispositions without any of them ultimately getting a grip on a concrete state of affairs.

In Robinson's original version, the Power Regress is meant to show that pandispositionalist worlds (worlds without nondispositional properties) are impossible. In the following, I reconstruct the Power Regress in a version that has a somewhat weaker conclusion but is, I believe, immune to the moves that friends of pandispositionalism ("PD" from now on) have developed against Robinson's regress and kindred arguments.[13]

I'll present an *epistemic* variant of the Power Regress. The gist of this version will be that if fundamental physical properties are dispositions, then fundamental

[13] There are at least five types of regress arguments against PD on the market, with the following respective conclusions: there is only potentiality ("always packing, never travelling," Armstrong 1997: 80), no power can manifest (Psillos 2006), knowledge is impossible (Swinburne 1986: 317), properties have no nature (Lowe 2010, Robinson 1982: 113–7, 2009), particulars cannot be individuated (Blackburn 1990: 63). As for pandispositionalists replies: Molnar (2003: 173–80) replies to Armstrong, Blackburn, and Martin. Bird (2007: 133–46) and Chakravartty (2007: 136–41) address Lowe, Robinson, and Swinburne. Marmodoro (2009) refutes Psillos. Marmodoro (2015) responds to Armstrong by arguing that the manifestation of a power isn't a property but an activity. See also Ingthorsson (forthcoming) for a critique of some of these defenses. Note that pandispositionalists sometimes embrace a regress instead of fighting it. For example, Bird (2007: 146) embraces the Lowe/Robinson regress (see Lowe 2010: 22–24 for a reply), and Anjum and Mumford (2011: 5–6) embrace Armstrong's regress.

physical objects are either not real or are not known to exist. This conclusion will be the basis of premise (II) from the Introduction.

The road map is as follows. Section 2.1.1 argues that every disposition has some characteristic effect that is definitive of its nature. Section 2.1.2 sets up an epistemic principle the gist of which is that dispositions instantiated in the extermal world are detected via characteristic effects. I'll argue that this principle, together with PD, entails that fundamental physical objects are either not real or are not known to exist. In 2.2, I'll show how this thesis (as well as Robinson's original Power Regress) can be used to establish idealism.

Throughout the discussion, PD will be identified with the following thesis:

(PD) All actual natural properties are dispositions.

By "properties," I mean both monadic properties and relations. By "natural properties," I mean sparse properties that carve nature at the joints and constitute an objectively privileged reductive basis for all facts about identity, causation, dispositions, chances, and laws. By "actual natural properties," I mean natural properties that are instantiated by actual concrete entities or could be instantiated by them, according to the laws that have instances in the actual world. As noted earlier, I'm using "powers" and "dispositions" interchangeably.[14]

2.1.2 Characteristic effects

By "a characteristic effect of disposition *D*," I mean a property the instantiation of which is a potential causal consequence of the activation of *D* such that this effect is definitive of the nature of *D*. If *E* is a characteristic effect of *D*, then bearers of *D* are disposed to bring about *E*. (If *E* is also a disposition, then *D* is the disposition to bring about the instantiation of *or* activation of *or* some change in the activity of, *E*.) For example, the characteristic effect of fragility is *being broken*, the characteristic effect of irascibility is *being angry*, the characteristic effects of charge are *being attracted to* and *being repelled by*, the characteristic effect of inertial mass is *resisting acceleration* etc.

As a general rule, the set of characteristic effects of *D* is not the same as the set of potential manifestations of *D*. If manifestations are states or events (or state or event types, e.g. if the manifestation of fragility is an event of breaking, or the state of being broken), then no characteristic effect of *D* is a manifestation of *D*, because characteristic effects (in the present terminology) are properties. Even if manifestations are taken to be properties, characteristic effects only form a subset of potential manifestations, because dispositions can manifest incompletely or in unusual ways. If a glass cracks because of a small blow, its fragility manifests,

[14] Some philosophers distinguish powers from dispositions. E.g. Fara (2005) thinks that being disposed to φ, unlike having the power to φ, implies a tendency to φ. (A similar distinction is employed by Vetter 2015.) I don't see such a distinction. Those who do are asked to read "power" as referring to dispositions.

but in an atypical way. Or, at any rate, this claim is defensible, so characteristic effects need not exhaust the set of potential manifestations.

I'll assume that every natural disposition has some characteristic effect. I find this assumption fairly straightforward, since dispositions are generally agreed to be dispositions *for* certain effects. Stock examples of dispositions all fit this pattern: the characteristic effect of fragility is *being broken*, the characteristic effect of radioactivity is decaying etc. But if an argument is needed for the claim that all (natural) dispositions have characteristic effects, here is one.

Suppose that some disposition δ has no characteristic effect. No nomically possible causal consequence of δ reveals the metaphysical nature of δ—in some situations, δ gives rise to property *P*, in other situations, it gives rise to a different property *Q* etc., and these patterns of activation are metaphysically disunified, so that no specific type of end result is the mark of δ. Let's say that δ is a *faceless* disposition if this is true.

If faceless dispositions were respectable posits, then arbitrary disjunctive dispositions would also be respectable posits. Or so I'll argue now. Consider *being fragile or magnetic*, a property I hereby baptize "fragnetism." Fragnetic things break when struck or they attract nearby metallic objects. Fragnetism has a scientifically well understood stimulus/response profile. Different bits of that profile come from different parts of physics, so fragnetism lacks a metaphysically unified set of characteristic effects. It is faceless. Generally, arbitrary disjunctions of dispositions are faceless. Hence, if faceless dispositions were respectable posits, then properties like fragnetism would be respectable posits. But they are not. Fragnetism has no place in a sane scientific conception of nature. So dispositions have characteristic effects.

I can think of three objections to this argument. The first is an appeal to what Nolan (forthcoming) calls "noncausal dispositions." Noncausal dispositions are dispositions that do not enter into causal relations. Nolan marshals a host of putative examples, including quantum entanglement, the Casimir effect (which appears to involve the creation of particles out of nothing), radioactivity, the disposition of the Nile to flood when the Sirius is in a certain position in the sky, the disposition of flowers to close when rain is coming etc. One might think that such purportedly noncausal dispositions challenge my foregoing argument about characteristic effects, because a noncausal disposition by definition has no effects whatsoever, so *a fortiori* it has no characteristic effects.

My reply is twofold. First, I'm not convinced that Nolan's examples are noncausal dispositions. Some of them seem to me causal (under certain views of causation, at any rate), while the others do not seem to me dispositions. (E.g. I don't think that the Nile is disposed to flood when the Sirius is in a certain position. If Sirius exploded, the Nile would flood just the same.)

Second, quibbles aside, noncausal dispositions can be integrated into this dialectic if we modify the terminology and replace "characteristic effects" with "characteristic consequences." Nolan's putative noncausal dispositions all have characteristic consequences: the characteristic consequence of the disposition of the Nile flood when Sirius is in a certain position is flooding, the characteristic consequences of radioactive dispositions are ionizing radiation and changes in the radioactive sample etc. Nothing in what follows hangs on whether these consequences are causal consequences. That said, I'll use "characteristic effects" to refer to such consequences, partly because I'm sceptical about the existence of noncausal dispositions and partly because this term is shorter.

Alternatively, one could trivialize the claim that all dispositions have some characteristic effect by adopting an extremely *fine-grained* view of dispositions. Consider a glass, Glenn, and suppose that the following are true:

(1) If Glenn is struck with a spoon, Glenn will crack.

(2) If Glenn is struck with a baseball bat, Glenn will shatter.

(3) If Glenn is struck with a baseball bat in the presence of a protective sorcerer, Glenn will start breaking but then it will miraculously reassemble.

And suppose one turns these conditionals into disposition ascriptions:

(1*) Glenn is disposed to crack when struck with a spoon.

(2*) Glenn is disposed to shatter when struck with a baseball bat.

(3*) Glenn is disposed to start breaking and then miraculously reassemble when struck with a baseball bat in the presence of a protective sorcerer.

One could adopt an extremely fine-grained ontology of dispositions and claim that these are three *different* dispositions. And one could cook up a host of similarly fine-grained dispositions to cover every potential manifestation of Glenn's fragility. On the resulting view, Glenn isn't simply fragile—Glenn has a whole family of powers that collectively constitute its fragility.

Such a fine-grained view of dispositions trivializes the claim that dispositions have characteristic effects. On such a view, a disposition can hardly have any *non*-characteristic effects: every disposition is so finely specified that it has only one potential effect in the first place.

My reply to this worry is to repeat the proviso that this dialectic is concerned with natural properties, those sparse properties that collectively constitute an objectively privileged reductive base for all facts about identity, causation, and laws. Dispositions like (1*)–(3*) are unlikely to be natural in that sense.

Finally, an interlocutor might complain that the distinction between characteristic and non-characteristic effects is epistemic and has nothing to do with the metaphysics of dispositions. The characteristic effects of *D* are potential effects of *D* that we routinely invoke to refer to *D*, but there is nothing *metaphysically* salient about them, *qua* effects of *D*, in comparison to all the other potential effects of *D*. Metaphysically speaking, a disposition is defined by the sum total of its potential effects, e.g. fragility is defined by facts like (1)–(3).

I believe that this worry flounders on the case of fragnetism. Fragnetism could also be associated with a pack of conditionals that are formally similar to (1)–(3). But that doesn't make fragnetism into a natural property. There must be some basis in reality for the fact that fragnetism is not a natural property but magnetism is. And it is hard to see what else the basis could be except that magnetism is metaphysically defined as a disposition for a certain (characteristic) effect.

The interlocutor might suggest that the real basis is constituted by the laws of magnetism: magnetism is a natural property and fragnetism isn't because the former features in laws and the latter doesn't.

I think that this suggestion is in the same general ballpark as my claim that dispositions have characteristic effects. For it is plausible to see laws as picking out robust objective similarities between certain sets of events, for example, between potential manifestations of magnetism. It would serve my argument just as well to identify the characteristic effects of *D* with lawlike similarities between potential manifestations of *D*. (I'll come back to this issue in 2.1.4). I conclude, therefore, that the thesis that every (natural) power has a characteristic effect is tenable.

2.1.3 The epistemic Power Regress

This section argues that if PD is true, then all non-mental natural properties are unknowable. By "mental properties," I mean first-person accessible properties of subjects, such as being in a certain sensory state, having a certain belief or desire etc. By "non-mental properties," I mean properties instantiated in the external world by brute physical objects. I'm not assuming that mental properties are natural. My claim is this: Only mental natural properties are knowable if PD is true, hence either PD is true and the non-mental parts of external reality are unknowable or PD is true and there is no external reality. (I'll define the sense of "unknowable" at play in a moment.)

The lynchpin of my argument will be the following principle:

(N) For any non-mental natural disposition *D*, for all times *t*,
if you learned at *t* that *D* is instantiated, then there is some
natural property *E* such that *E* is the characteristic effect of
some non-mental natural disposition and for some $\tau < t$,
you learned at τ that *E* is instantiated.

"You" refers to normal human subjects engaging in the epistemic practices we normally engage in (scientific experimentation is ruled in; divine revelation ruled out). By saying that some *S* learned at *t* that *P* is instantiated, I mean that, at *t*, *S* identified some bearer of *P* as a bearer of *P*. For example, Alice learned at *t* that the property of being H_2O is instantiated iff, at *t*, Alice identified some sample of H_2O as stuff containing molecules composed of hydrogen and oxygen. (Such acts of recognition take time, so speaking of *the* time *t* at which they occur is unrealistic. To reduce clutter, I'll stick to this fiction, though. Strictly speaking, "*t*" and "τ" are meant to be variables for non-overlapping periods of time.)

The gist of (N) is that we cannot detect a non-mental disposition without having detected some characteristic effect of a non-mental disposition. I'll justify this thesis in two phases. First, I'll explain why mental dispositions do not obey this logic. Second, I'll argue that non-mental dispositions do.

Mental dispositions appear to be directly knowable in the sense that you can identify yourself as the bearer of such a disposition without the mediation of the recognition of any other property instance. You don't have to learn anything else to learn that you are angry or to learn that you believe that 1+1 is 2 or to learn that you like chocolate or to learn that you can read English etc. So it is plausible to think that an analogue of (N) does not hold for mental dispositions.[15]

Such unmediated knowledge is harder to come by in the case of non-mental dispositions, though. Intuitively, to learn that a non-mental disposition *D* is instantiated, you must first see *D* do its work, otherwise you have no reason to assume that a disposition like *D* is present in the world. Suppose, for illustration, that you are presented with red and blue cubes. You are told that some of them have a certain disposition. You're supposed to find out what it is. It turns out that if you drop a red cube, it breaks. If you drop a blue cube, it does not break. You are given an unlimited supply of red and blue cubes, and the pattern invariably persists. It is reasonable for you to conclude that the red cubes are fragile and the blue cubes are not. But it would have been unreasonable for you to conclude this without seeing some red cubes break and some blue cubes survive the fall. So, as a first-pass heuristic, it seems correct to say that a non-mental disposition *D* is detected by learning about the instantiation of the characteristic effects of some non-mental disposition, namely *D*. If this heuristic were failsafe, then (N) would be true.

The heuristic is not failsafe. There are easy and hard challenges. The easy challenge says that we don't have to break every glass to know that glasses are fragile. One can learn that something is fragile without seeing it break.[16]

[15] Of course, it is only our *own* mental dispositions that are directly knowable in this sense. Or, at any rate, the analogous claim for the states of other minds seems harder to push though. Let me bracket this problem here.

[16] Certain tribes of sceptics might deny this, but let's ignore them.

This is an easy challenge, because the heuristic that is being challenged does not say that you can only attribute D to x if you saw x manifest D. In the earlier thought experiment, you attributed fragility to all the red cubes without breaking all of them. The heuristic only implies that you must see *some* red cubes break in order to know that fragility is instantiated by them.

Now the hard challenge. It's July 16, 1945. Physicists in Los Alamos are standing in front of the first nuclear test bomb, which was called "the Gadget." They have just finished the last check on all their calculations. Now they are certain that the Gadget has the power to destroy a village. Let's assume that, on the basis of those calculations and the smaller-scale experiments that supported the calculations, the physicists have *learned* that the Gadget has the power to destroy a village. Since they learned about the instantiation of this power without having seen that power manifest (the Gadget being the first nuclear device), the heuristic that powers are detected by their characteristic effects is false. And since this heuristic is the only support for (N) at this point, (N) is challenged.

This case refutes the heuristic in question but it does not refute (N) thereby. On the contrary, it lends additional support to (N). To see why, suppose that one of the physicists, Bill, has gone mad because of the pressure, and he thinks that the Gadget has the power to end the world. Both Bill and his colleagues attribute a power to the Gadget that they never saw manifest. But Bill's colleagues *did* learn (we assume) that the Gadget has the power to destroy a village, while Bill did *not* learn that the Gadget has the power to end the world. And the reason why Bill's colleagues learned that the Gadget has the power they think it has is that they had previously learned that the parts of the Gadget have powers that, when combined in a certain way, add up to the power to destroy a village. And the way they learned *that* was by learning that the characteristic effects of those powers are instantiated in certain circumstances (namely, in the context of small-scale experiments concerning radioactivity). The physicists never saw the Gadget's power manifest, but they saw the powers of parts of the Gadget manifest.

It follows that even if there are counterexamples to the heuristic that non-mental powers are detected by their own characteristic effects, it is nonetheless true that non-mental powers are detected by the characteristic effects of *some* non-mental powers, as (N) says. This is the only explanation for the contrast between the truth value of Bill's and his colleagues' power ascriptions.

Let me stop here and indicate why (N) is a threat to PD before I address other objections.

The conjunction of PD and (N) entails that for no actual non-mental natural property P can we learn that P is instantiated. Let P_1 be a non-mental natural property such that, for some t_1, you learned at t_1 that is P_1 instantiated. By PD, it follows that P_1 is a disposition. So by (N), it follows that there is some non-mental natural property P_2 and time $t_2 < t_1$ such that you learned at t_2 that P_2 is instantiated. By PD, P_2 is a (non-mental) disposition. So by (N), there is some non-mental natural property P_3 and time $t_3 < t_2$ such that you learned at t_3 that P_3 is instantiated. By PD, P_3 is a disposition. So by (N)... etc. An infinite series is developing:

PROPERTY	P_1		P_2		P_3		P_4	...etc.
DETECTED AT	t_1	$>$	t_2	$>$	t_3	$>$	t_4	...etc.

Either the series t_i tends toward $-\infty$ or it converges to a specific past moment, say T. In the former case, the fact that S learned that P_1 is instantiated entails that S has always existed. Since we are talking about normal human cognizers, this possibility is ruled out. It follows that t_i converges to a specific past moment T. But then the distance between successive t_is must keep growing smaller. Hence, an arbitrarily small neighbourhood of T will contain at least one complete act of property-identification. By choosing the neighbourhood to be smaller than the smallest period in which a human can apprehend anything, we reach an impossibility: in order to learn that P_1 is instantiated, you must have performed a mental act during a period which is smaller than the smallest period in which you can perform a mental act.[17]

It follows that either PD is false or for no non-mental natural property P can we ever learn that P is instantiated. In other words, if PD is true, then non-mental external reality is unknowable or it does not exist.[18]

It might be objected that learning about the instantiation of some non-mental power P could bottom out in the awareness of some sensory state (i.e. in learning about the instantiation of a perceptual disposition). And since knowing our own mental states needs no further mediation, the regress does not get going.

This objection has two readings. On the *first* reading, detecting some mental property M is sufficient for us to learn that a non-mental power P is instantiated because M is a characteristic effect of P. Given the concept of characteristic effects, this idea only works if non-mental natural powers are such that bringing about certain mental states is definitive of their nature. So the objection defuses my argument by turning PD into a form of idealism. (I'll come back to this issue in a moment.)

[17] This conclusion holds even if we assume, more realistically, that the t_i are not instants but (nonoverlapping) durations. Either these durations stretch into $-\infty$, or they converge to a point, and if they converge to a point, they must get arbitrarily small.

[18] This argument is similar to Swinburne's (1980: 317) epistemic regress, with some crucial ambiguities removed. Swinburne talks about the "recognition" of powers and the effects powers "typically" produce, without telling us whether recognition means mere perceptual registering, whether typicality is an epistemic or metaphysical notion, and whether the powers in question are non-mental. As a result, his case against PD is routinely resisted by appeal to dispositional mental states that are known without further mediation (Bird 2007: 133–5, Chakravartty 2007: 136–7). In contrast, the present argument makes it clear that what is at stake is the recognition of non-mental powers for the kind of powers they are, which requires prior awareness of some non-mental characteristic effect. This regress cannot be stopped by appeal to mental states.

One could suggest that non-mental powers could have typical *sensory* effects which allow us to learn that they are instantiated. For example, fragility, if activated, typically causes the visual experience of shards flying apart. If non-mental dispositions are detected by their typical sensory effects, then non-mental reality is knowable and there is no threat of idealism or weird panpsychism.

This suggestion supplies the *second* reading of the objection at hand. This version of the objection says that there is a distinction between the typical *sensory* effects and the characteristic (non-mental) effects of powers. The claim is that being aware of a typical sensory effect *M* of a non-mental power *P* is sufficient for us to learn that *P* is instantiated.

This claim, in turn, has two readings. On the first, *M* is the property of perceiving some characteristic (non-mental) effect *Q* of *P*. This reading does not stop the regress, because, by PD, *Q* is also a power. Iterating the rule, we have the condition that you must have perceived some characteristic (non-mental) effect *R* of *Q* before you learned that *Q* is instantiated. *R* is also a power... etc. Alternatively, one can deny that *M* is property of perceiving *Q* and one can say, instead, that the state of instantiating *M* is a state with a purely internal content (e.g. *M* is the property of experiencing certain qualia) and instantiating *M*, whether or not this amounts to perceiving *Q*, is sufficient for us to learn that *P* is instantiated. But then phenomenalism rears its head again—if you can identify *P* as the kind of power it is (which, in the present terminology, is necessary for learning that *P* is instantiated) solely on the basis mental states that have no external content, then the nature of *P*, as far as you are concerned, is exhausted by the fact that it affects your mind in a certain way.

So pandispositionalism leads to the consequence that either no non-mental natural property is or will be known to be instantiated or non-mental natural properties are metaphysically defined by the way they affect minds. I take it that the first horn must be denied by all sane physical realists. Moreover, it is hard to see how the second horn could be true without idealism being true. For suppose that all non-mental powers in the actual world are defined by the way they affect minds. Let N_1, N_2... be the powers in question. And suppose that N_1, N_2... are instantiated in a world *W* that does not contain subjects and does not contain any powers apart from N_1, N_2... . Since the characteristic effects of N_1, N_2... all involve subjects, it follows that N_1, N_2... never manifest their characteristic effects in *W*. Hence either no power ever manifests in *W* (which makes *W* is indistinguishable from an empty world, since the concrete realm in *W* consists of powers that never manifest) or N_1, N_2... only manifest in *un*characteristic ways in *W*. But it is hard to see how they could do the latter, given that the nature of N_1, N_2... is tied to the mental. So the claim that all non-mental powers are defined in terms of their effects on minds is either straightforwardly idealistic notion, or it is mysterious and possibly unintelligible.

The epistemic Power Regress therefore shows that if pandospositionalism is true, then either we will always be ignorant about non-mental natural properties, or idealism is true, or some mysterious and possibly unintelligible doctrine is true. In all three cases, standard physical realism is false. Standard physical realism is false if we will always be ignorant about non-mental natural properties, because standard physical realists assume that we know about various real physical properties. Standard physical realism is obviously false if idealism is true, and it is false if the mysterious and possibly unintelligible doctrine intimated earlier is true, because that doctrine is predicated on the claim that non-mental physical properties are metaphysically defined by their effects on minds. Hence, given the epistemic Power Regress, all possible consequences of PD are incompatible with standard physical realism.

I conclude that if pandispositionalism is true, then standard physical realism is false. Hence, in the context of the present dialectic, which pits idealism against standard physical realism, premise (II) of my main argument is warranted:

(II) If physical objects are real, they have real categorical properties.

2.1.4 The challenge of causal structuralism

John Hawthorne (2001) outlines a version of the causal theory of properties that is not explicitly committed to dispositions. Since the epistemic Power Regress was targeted at dispositional ontologies, one might think that causal structuralism is a good cure against the Power Regress. To round off my reconstruction and reformulation of the Power Regress, I'd like to indicate why causal structuralism does not substantively challenge the foregoing argument.

Causal structuralism is the view that natural properties are individuated by their extrinsic causal relations to each other, as described by the Ramsified version of the actual laws. This view retains the intuition that natural properties *are* what they *do*, but no reference is made to dispositions. By adopting causal structuralism, the physical realist can accommodate the empirical fact that the properties known from science appear to be defined by what they do, but she can do this (seemingly) without exposing herself to the Power Regress, either in its original version or in its epistemic reformulation.

I believe that causal structuralism can only provide false hope for the physical realist. Causal structuralism escapes the letter of the Power Regress but it does not escape its spirit. Less cryptically, the Power Regress (or its epistemic version, at any rate) can be reformulated in the context of causal structuralism just as well. Let me elaborate.

Suppose, as causal structuralists urge, that the nomic profile of any natural property *P* (the sum total of *P*'s causal relations to other properties, as described by the Ramsified actual laws) is definitive of the nature of *P*. And consider this reformulation of the principle that drives the epistemic Power Regress:

(N*) For any non-mental natural property *P*, for all times *t*, if you learned at *t* that *P* is instantiated, then there is some non-mental natural property *Q* such that *Q* is part of the nomic profile of some non-mental natural property and for some $\tau < t$, you learned at τ that *Q* is instantiated.

One can justify (N*) in much the same way as one can justify (N) (indeed, using the very same examples). Suppose you are given blue and red cubes and you are asked to figure out the nomic role of their colours (for simplicity, let the only nomically relevant property of the cubes be their colour). You need to see some red cubes break and some blue ones survive the fall to learn that it is part of the nomic profile of redness that it makes cubes fragile. Or take the case of the physicists contemplating the Gadget. They have learned (we assume) that the capability to destroy a village is part of the (collective) nomic profile of the natural properties instantiated by the Gadget. And the physicists learned this by learning that some components of the nomic profile of parts of the Gadget are instantiated. So whatever justifies (N) seems, *mutatis mutandis*, to justify (N*), if causal structuralism is true.

(N*) leads to the same absurd result that (N), coupled with PD, leads to. Suppose that for some non-mental natural property P_1, we learned at t_1 that P_1 is instantiated. Then, by (N*), there is a non-mental property P_2 and time $t_2 < t_1$ such that P_2 is part of the nomic profile of some natural property and we learned at t_2 that P_2 is instantiated. P_2 is a non-mental property, so by (N*), there is a non-mental property P_3 and time $t_3 < t_3$ such that we learned at t_3 that P_3 is instantiated... etc. The series t_i either goes to $-\infty$ or it converges to a past time *T*. The first possibility is ruled out, because no human has lived forever. So the series converges to some *T*. Because it converges to *T*, the distance between successive members of t_i gets arbitrarily small, so it will follow that we have performed a mental act (learned about the instantiation of some non-mental natural property) during a period which is smaller than the smallest period in which we can perform any mental act.

It follows that causal structuralism only escapes the letter of the Power Regress but not its spirit, because the Power Regress can be transferred from the context of dispositionalist ontologies into the context of ontologies where natural properties are individuated by their nomic roles. The epistemic principle that generates trouble in the first context has a straightforward analogue in the second context. Adopting causal structuralism therefore does not help the physical realist to evade premise (II), which is warranted by the epistemic Power Regress whether we go for pandispositionalism or causal structuralism.

2.2 Resisting the Power Regress

2.2.1 From the Power Regress to idealism

Howard Robinson originally offered the Power Regress as an argument for idealism. In the present section, I discuss how one can use the Power Regress for such purposes.

We saw at the beginning of 2.1 that paradigm physical properties, for example the property of having mass, appear to be dispositions. If it can be shown that all physical properties are dispositions, then the Power Regress causes real headache to physical realists, because it straightforwardly refutes their ideology:

(1) If physical objects are real, they have real categorical properties. (by the Power Regress)

(2) All physical properties are dispositions

(3) Therefore, physical objects are not real.

In the original Robinsonian version, the Power Regress entails (1) because it establishes that physical properties are metaphysically empty if all physical properties are dispositions. I defended (1) on the basis of the epistemic Power Regress and in a context restricted to the debate between idealism and standard physical realism, the latter of which is committed to the thesis that brute physical objects are known to exist and are not essentially related to mentality. I argued that, under such presuppositions, (1) is warranted.

In the rest of 2.2, my goal will be to examine (2), or, more precisely, a version of (2) which is limited to fundamental physics:

(2*) All fundamental physical properties (that is, all natural properties of the particles and fields studied in fundamental physics) are dispositions .

I assume that establishing (2*) is enough to get physical realism is trouble, using the following variant on (1)–(3):

(1) If physical objects are real, they have real categorical properties.

(2*) All fundamental physical properties are dispositions .

(3*) If physical objects are real, then fundamental physical entities are real.

(4*) Therefore, by (1) and (2*), fundamental physical entities are not real.

(5*) Therefore, by (3*) and (4*), physical objects are not real.

This variation of (1)–(3) has one more extra premise, (3*), which says that physical objects cannot be real without their fundamental constituents being real. (Let's forget about the issue whether these fundamental constituents are particles, fields, strings, or even more exotic objects, and let's not worry about the details of how these fundamental elements constitute the rest of the physical world. These issues are unlikely to impact the present dialectic. And even if I'm wrong about that, those issues are so difficult and controversial that it would be silly to try to solve them here.)

One can, of course, be a physical realist despite denying (3*). One can believe that there are real physical objects while denying that fundamental particles and fields (strings etc.) are among them. But this is not the standard form of physical realism. In any case, as indicated in the Introduction, I'm using "standard physical realism" to refer to a doctrine, apparently quite prevalent, according to which fundamental physical entities are real. So (3*) is warranted in the context of the present defense of idealism.

2.2.2 Are fundamental physical properties dispositions?

Ordinarily, we often think of physical objects in terms of nondispositional or not obviously dispositional features, such as shape, texture, and colour. But most of these properties either fall out of the picture when we move from the manifest image to the scientific image, or they take on dispositional clothing, along with the rest of the physical world. As Simon Blackburn remarks,

> Resistance is *par excellence* dispositional; extension is only of use, as Leibniz insisted, if there is some other property whose instancing defines the boundaries; hardness goes with resistance, and mass is knowable only by its dynamical effects. Turn up the magnification and we find things like an electrical charge at a point, or rather varying over a region, but the magnitude of a field at a region is known only through its effect on other things in spatial relations to that region. A region with charge is very different from a region without: perhaps different enough to explain all we could ever know about nature. It differs precisely in its dispositions or powers. But science finds only dispositional properties, all the way down. (Blackburn 1990: 62–3)

Frank Jackson thinks that fundamental physical properties cannot help being dispositional, since physics investigates the causal role of properties and these, in turn, are cashed out in terms of dispositions:

> When physicists tell us about the properties they take to be fundamental, they tell us what these properties do. This is no accident. We know about what things are like essentially through the way they impinge on us and our measuring instruments. (Jackson 1998: 23)

Similarly, Brian Ellis and Caroline Lierse assert that

> With few exceptions, the most fundamental properties that we know about are all dispositional. They are of the nature of powers, capacities and propensities. (Ellis and Lierse 1994: 32)

Indeed, the fact that the sciences investigate causal roles has led a number of philosophers to embrace the thesis that *all* properties (or, at any rate, all properties instantiated in the concrete world) are dispositions. One purported advantage of this view is that it makes the nature of properties epistemically accessible. If there would be more to properties than their causal role, then we could not know about their real nature, at least when it comes to subatomic properties that are not directly manifest in sense experience.[19]

The claim that physical properties are at bottom dispositional appears to be strongly supported by contemporary physics. Consider the following summary of the current standard model of particle physics:

> Currently, the term "elementary particle" denotes some particles which are globally called *leptons*, and the *quarks*. […] The quarks and leptons [are] currently considered to be the ultimate constituents of matter. […] A description of the structure of matter cannot be complete without considering the interactions (forces) that "join" the particles and more generally that regulate the interactions amongst them. The *strong*, *weak*, *electromagnetic* and *gravitational* interactions were identified. Each interaction has its own force particles [*bosons*] that relay the interaction. […] The *photons* mediate the electromagnetic interaction, the W^+, W^- and Z^0 *vector bosons* the weak interaction, the eight *gluons* the strong interaction and the hypothetical *graviton* the gravitational interaction. (Braibant et al. 2009: 1–2)

As Braibant et al. explain, elementary particles have four fundamental properties: typical lifetime, mass, spin (which expresses the angular momentum of a particle), and the baryonic or leptonic numbers, which, through various conservation principles, control the way that particles decay into other particles (op.cit. 109–10). At least three out of these four properties (mass, spin, and baryonic/leptonic number) appear to be dispositional. (Typical lifetime is also dispositional if one interprets it as a propensity to persist.) This impression is reinforced when we consider the nature of fundamental interactions:

> At present we know of four types of forces as basic interactions in Nature. The strongest of them is the *nuclear force*, attracting protons and neutrons inside the atomic nucleus, although its range is limited to

[19] See e.g. Yates (2013: 95). For a critical discussion of this point by a dispositionalist, see Hawthorne (2001: 365–8). In light of the epistemic Power Regress, pandispositionalism is unlikely to be defensible on the grounds that it makes nature knowable.

> distances of the order of the diameter of the atomic nucleus, i.e., 10^{-13} cm. After this, the next strongest is the *electromagnetic force*, which is exerted between electrically charged particles, and in particular which attracts protons and electrons to form the atom. Then follows the so-called *weak force*, mediating the beta decay of nuclei. This is also a short-range force. […] Finally, the weakest is the *gravitational force*. Like the electromagnetic force, this has long range. All other interactions observed in Nature can be reduced to these four forces. (Chaichian 2014: 279)

The current standard model of fundamental physics invites us to think of the world in terms of four types of forces that influence the generation and movement of elementary particles that are in a large part individuated by dispositional properties. So contemporary physics seems very much open to the interpretation that fundamental physical properties are typically dispositions.

2.2.3 The problem of spatiotemporal position

Although the view that fundamental physical properties are mostly dispositions seems fairly uncontroversial, one can raise objections against the thesis that *all* fundamental physical properties are dispositional. One important objection is that spatiotemporal position is not, or is not easily interpreted as, a disposition. The fact that a physical object is somewhere in spacetime or that it has a certain trajectory in spacetime seems to be a structural feature about the world and not a fact about the particle's readiness to induce or undergo changes.

One might try reducing spatiotemporal properties to conditionals in order to portray them as (possibly noncausal) dispositions. For example, one might propose to reduce the fact that *x* is in New York to facts like the following:

(6) If *x* travels at 100mph westward for 4 hours 49 minutes,
then *x* will be in Detroit.

(7) If *x* travels at 100mph southward for 10 hours 55 minutes,
then *x* will be in Miami. ...etc.

However, these conditionals contain spatiotemporal properties, so facts like (6) and (7) reduce the property of being in New York to an antecedently given stock of other spatiotemporal properties. This is a problem because the reductive basis itself does not resolve into conditionals like (6) or (7). (And if it does, then one can ask a similar question about the reductive basis of *those* conditionals.)

Friends of the dispositionalist view of spacetime ("DS" henceforth) may try to solve this issue by going *structuralist* and claiming that spatiotemporal locations are extrinsically individuated by each other.[20] But structuralism by itself

[20] This how Bird (2007:138–45) sidesteps the general worry that PD introduces infinite or circular dependence into the ontology of properties. See Lowe (2010: 22–24) for a reply.

does not solve this issue, because it does not automatically render spatiotemporal properties dispositional. After all, the structuralist move is also available to those who think that spatiotemporal location is not a power but an intrinsically nonmodal geometrical feature. One is not inclined to conclude that *being a unit circle* is a disposition from the claims that (i) if x and y are on the unit circle, then x and y are of unit distance from the origin (plus a host of similar conditionals hold, à la (6), (7), and their kin), and (ii) geometrical properties are extrinsically individuated by each other. So a friend of PD who goes structuralist and points to facts like (6) and (7) does not thereby establish that spatiotemporal location is a power.

Bird (2007: 166) claims that general relativity does the trick: spatiotemporal position is a power because spacetime reacts dynamically to the presence of matter in general relativity, which is our current best theory of spacetime.

Apart from various technical difficulties about treating the equations of general relativity as describing dispositions,[21] this suggestion is open to the worry that the spatiotemporal distance between two objects does not seem to be a force that reacts to anything nor is it an entity that has the passive power to be distorted. O_1 and O_2 might distort spacetime in such a way that they are 5 feet apart (in some frame at some time), but *being 5 feet apart* does not get distorted in any way. The pandispositionalist who appeals to general relativity must claim that the property of being 5 feet apart is a disposition because, thanks to the dynamic laws of general relativity, *being 5 feet apart* appears in conditionals that define possible trajectories. But that fact in itself does not make spatiotemporal position into a power any more than the fact that this glass will break if a bomb detonates 5 feet away makes *being 5 feet away* into a disposition. If being part of some conditional were sufficient for being a disposition, then friends of DS wouldn't have to bother with general relativity in the first place. But being part of some conditional is obviously insufficient for being a disposition. So the fact (*if* it is a fact) that spacetime reacts dynamically to matter in general relativity does not by itself guarantee that spatiotemporal properties are dispositions.

I conclude that premise (2) of the antiphysicalist arguments from the Power Regress is open to the objection that spatiotemporal position is not a disposition and hence not all properties known from physics are dispositions. We saw that this claim can only be resisted by controversial technical arguments about general relativity. It follows that the soundness of Robinson's case for idealism (and of my own epistemic variation on it) is far from evident.[22]

[21] See Bartels (2013) and Livanios (2008) for two arguments that GR is not dispositionalist.

[22] It might be argued that spatiotemporal position cannot be the only nondispositional feature of a real object. But physical realists can reply that filling in space is a primitive property (one that we understand because we understand geometry). Once spatiotemporal position is acknowledged to be a real feature in the physical world, idealism is in trouble.

2.2.4 Unknown categorical bases

Some philosophers argue that even if we lay aside spatiotemporal properties, we have no reason to think that the dispositions studied in physics have no categorical bases. As J. L. Mackie explains,

> The old definition of mass as quantity of matter is […] not so far from the mark after all. It is true that we do not know much about what matter is; but it is reasonable to postulate that there is a relatively permanent quantitative something-or-other intrinsic to objects […]. In saying that an object has such-and-such a mass we may reasonably opt for the interpretation that this is to say that it is such that a certain set of conditionals holds, and that although this style of introduction is dispositional, what is introduced is an intrinsic, quantitative, but otherwise mainly unknown feature. (Mackie 1973: 151)

George Molnar also endorses the idea of primitive categorical bases:

> If the property of exerting a certain force is a definite *something* that the numbers can measure, so is being the *source* of that force. That *about the object* that makes it a source of a force is a (quantitative) power property. It is open to the dispositionalist to say that this is where the quiddity lies, this is what the numbers are numbers of. (Molnar 2003: 179)

The gist of these suggestions is that physical realists are free to assume that pieces of matter have some categorical feature in virtue of which they have the dispositions that physics investigates. For example, physical realists are free to claim that there is some quantity of matter wherever there is a disposition to move, or that there is a categorical source of electric force in charged bodies.

However, one can argue that positing primitive categorical bases is not by definition a *physical realist* rescue strategy. If the categorical bases are unknown, they could just as well be mental as physical (or neither). Hence even if the hypothesis of unknown categorical bases were methodologically kosher (because of the principle of humility, or whatever), it would not constitute a good escape route for physical realism, especially not for standard physical realism. And since this dissertation is a defense of idealism against standard physical realism, unknown categorical bases can be ignored in this dialectic.

2.2.5 Summary of 2.1 and 2.2

In 2.1 and 2.2, I reconstructed Howard Robinson's argument for idealism in two stages. In 2.1, I stated the Power Regress in its original form, which concludes that every real objects must have real categorical properties. I then defended a variation on this argument, a variation I called "the epistemic Power Regress." This argument is meant to show that if all natural properties are dispositions, then either non-mental properties are unknowable or idealism is true or some (possible incoherent) ontological thesis follows that is bound to be incompatible with standard physical realism.

Section 2.2.1 showed how the Power Regress leads to idealism. The crux of the idealist applications of the Power Regress is the thesis that all fundamental physical properties are dispositions. In 2.2.2, I argued that fundamental physical properties are typically dispositions. In 2.2.3, I claimed that this thesis is harder to maintain for all fundamental physical properties, because spatiotemporal position does not seem to be a disposition. I indicated that this idea might be open to objections from general relativity, but these objections are far from decisive and hence the claim that the idealist application of the Power Regress is unsound is defensible without invoking any specific physical realist intuition. Section 2.2.4 dealt with the claim that physical dispositions may have real categorical bases. I conceded that this is possible, but I emphasized that positing primitive categorical bases is not warranted in the context of the debate between idealism and standard physical realism.

It follows that one can build an argument for idealism that is immune to the objections to Robinson's argument if one shows that (i) spatiotemporal position is not a real property and (ii) there are no good independent reasons to prefer physical realism to idealism. This move exposes the physical realist to the Power Regress without assuming that no physical property is categorical. I'll explore this strategy in a bit more detail at the end of this chapter, after John Foster's arguments against real space have been explored.

2.3 Scrambled and gappy worlds

John Foster constructed a number of ingenious thought experiments to prove that space isn't real. His dialectic, originally presented in Parts III and IV of *The Case for Idealism*, revolves around two arguments. Section 2.3.1 discusses Foster's *modal* argument and section 2.3.2 reconstructs his *abductive* argument. I'll argue that both arguments are eminently defensible and they force the physical realist to embrace an implausible metaphysical principle or to come up with independent reasons to prefer physical realism to idealism.

2.3.1 The modal argument against spatial realism

Foster's modal argument against real space is based on the combination of two ideas, both of which follow from physical realism, according to Foster. The first claim is that that the laws of nature are contingent, and the second is the claim that the structure of a space is essential to its identity:

> [T]here are two principles which are individually undeniable but irreconcilable from the standpoint of spatial realism. The first, which we may call the *principle of variability*, is that, for any ontologically

> primitive item, the physical geometry of that item, if it has one, […] is subject to variation, through different possible worlds, with variation in the relevant laws. The second, […] the *principle of constancy*, is that, for any genuine space, the geometrical structure of that space is essential to its identity and holds constant through all possible worlds in which the space exists, whatever the variations in nomological organization. These two principles are, clearly, jointly incompatible with the claim that physical space is ontologically primitive. For if [it is], then, by the one principle, its geometrical structure varies from world to world according to its nomological organization, while, by the other principle, its geometrical structure remains constant with the constancy of its identity. (Foster 1982: 172)[23]

Let me introduce the concept of transworld variation to reconstruct Foster's modal argument:

Transworld Variation:

x can undergo transworld variation in terms of $y =_{df}$ x exists in more than one possible world and x isn't qualitatively the same in all worlds in terms of y (e.g. spacetime in terms of the laws that it sustains).

With this concept in place, Foster's modal argument against spatial realism can be reconstructed as a simple but powerful *modus tollens*:

(1) If physical space is real, it can undergo transworld variation in terms of the laws that it sustains.

(2) Physical space cannot undergo transworld variation in terms of the laws that it sustains.

(3) Therefore, physical space isn't real.

Premise (1) is plausible if we conceive of physical space (or spacetime—I'll use these terms interchangeably) as a (substantival) categorical structure which is independent of how the objects it contains behave. This assumption does not limit the scope of the present dialectic, for two reasons. First, if spacetime is a relational, dispositional structure, it falls under the purview of the Power Regress (in both its original Robinsonian version and in the epistemic version I defended). So if the soundness of (1)–(3) hangs on the tenability of the claim that spacetime is not a dispositional structure, then physical realists are not better off proving that (1)–(3) is unsound, because they only makes themselves subject to the Power Regress and the argument for idealism that the latter grounds (2.2.1).

[23] Foster defines realism about spacetime as the thesis that spacetime is ontologically primitive (or fundamental). I'll reconstruct his argument in the terminology of real vs. ideal structures instead. This move seems justified since Foster (1982: 162) identifies anti-realism about *x*s with the thesis that *x*s are not ontologically primitive.

Second, Foster himself offers a separate argument against relational space. His argument is based on the possibility that minds could switch bodies in a law-governed way, yielding possible worlds that are physically indiscernible. By investigating the identity criteria for bodies in these physically indiscernible worlds, Foster claims to derive a contradiction from the relationalist version of physical realism (Foster 1982: 182–7). I won't reconstruct and defend this argument here because, as I have indicated, the Power Regress is enough to defend the present dialectic against relationalist denials of (1). But it is important to keep in mind that the conclusion, (3), is defensible against the relationalist move even in its original Fosterian context.

Premise (2) says that physical space cannot undergo variation in terms of the laws it sustains. This idea can be established through an analysis of spatially irregular worlds. More specifically, it can be reduced to the thesis that a certain type of structural anomaly is physically irrelevant. Let me elaborate.

Imagine that, unbeknownst to you, your bathroom is on the Moon but, due to a nomic irregularity, you never notice this, because the moment you cross the threshold of your bathroom, you are imperceptibly teleported to the Moon, where the laws of gravity are locally overruled and everything feels like home. The illusion is so perfect that electromagnetic rays traveling to your bathroom also teleport to the Moon, so visual experience suggests that you are still in your apartment on Earth. Similar irregularities guarantee that astronomers never catch you in the shower while they are scanning the heavens. All relevant laws of nature are mucked up in such a way that the illusion is simply perfect. Let's say that the world is *scrambled* iff such deceptions obtain. Scrambled worlds are easily conceivable if we assume that space is a real structure that is metaphysically independent of the way that things in it move.

Let's investigate in a bit more detail the metaphysics of scrambled worlds. What happens in scrambled worlds is that the geometrical structure of spacetime (the metrical relations between objects, e.g. the primitive distance between your bathroom and the Moon) do not match the kinematic structure (e.g. some inertial trajectories are discontinuous according to the primitive metric). Your bathroom is geometrically on the Moon (because the primitive distance between it and portions of the Moon is small), but, kinematically, it is on Earth (because, say, it takes relatively little energy to move from your bathroom to your living room but it takes a lot of energy to move from your living room to the Moon).

If premise (2) is false, i.e. if physical space can undergo transworld variation in terms of the laws that it sustains, then scrambled worlds were physically different from their unscrambled counterparts. For suppose that physical space can undergo transworld variation in terms of laws (= ~(2)). Let world *A* and *B* have the same physical space but different kinematic laws. Arguably, the identity of a spacetime depends on its structure, so the *A*-spacetime and the *B*-spacetime must have the same underlying structure to qualify as the same spacetime. This underlying structure cannot encode the kinematic laws, since those differ between *A* and *B*. So there must be difference between the primitive geometry of *A* and *B* (which remains constant as we move from *A* to *B*) and their kinematic structure (which varies from *A* to *B*). So the negation of (2) entails that the primitive geometry and the kinematic structure of physical space can come apart. Scrambled worlds and their unscrambled counterparts are precisely those worlds where these two structures come apart. So if (2) is false, then there is a physical difference between a scrambled world (*A*) and its unscrambled or differently scrambled counterpart (*B*).

But no such difference is discernible. Suppose, for example, that in *A*, Africa is near Europe, and in *B*, Africa is on the Moon in terms of primitive geometry, but kinematically, things behave the same in the two worlds. A meteor hits the Mediterranean in both worlds, causing a tsunami. Given the identity of kinematic laws, the tsunami will have the same effects on Africa and Europe in *A* and *B*. So the fact that Africa is on the Moon in *B* makes no physical difference whatsoever.[24] The example obviously generalizes.

The physical irrelevance of scrambling can be demonstrated by a different route as well. Let Rα and Rβ be two representations of our spacetime (which we assume to be unscrambled). Both Rα and Rβ assign three numbers to all particles in the universe. Rα does this in a natural way, using the center of the Sun as the origin. We generate Rβ by setting up an arbitrary bijection between the points in Africa and the points in some region of the Moon, swapping their Rα-coordinates and leaving Rα the same otherwise. The result, Rβ, is a different way to label the particles in our universe with triples of numbers.

If there were a physically relevant difference between scrambled worlds and their unscrambled (or differently scrambled) counterparts, then the difference between Rα and Rβ would encode a physical difference between two possible worlds, specifically, it would encode the physical difference between *A* and *B* from the previous example (where *A* = our world, *B* = a world where Africa is on the Moon geometrically but things behave as in *A*). But these two representations do not encode any physically relevant difference. Both Rα and Rβ can represent both *A* and *B* equally well. Rα represents *A* if we measure the distances of particles from the center of the Sun, and Rα represents *B* if we measure the distances of particles from the center of the Sun *and* we add the Earth–Moon distance in the case of the particles in Africa *and* we subtract the same distance in the case of particles in some area on the Moon. Similarly, Rβ represents *B* if we measure the distances of particles from the center of the Sun, and Rβ represents *A* if we measure the distances of particles from the center of the Sun

[24] This point was made by Howard Robinson in conversation.

and we subtract the Earth–Moon distance in the case of the particles in Africa *and* we add the same distance in the case of particles in some area on the Moon. And once we fix a representation (say Rα) for both worlds, the kinematic laws of the two worlds will look the same. So the difference between Rα and Rβ boils down to a difference between a natural and a gerrymandered way of representing distances. It does not encode any physical difference.

To sum up, premise (2), the principle of constancy, is supported by the following reasoning:

(4) If physical space can undergo transworld variation, then the primitive geometry and the kinematic structure of physical space can come apart.

(5) If the primitive geometry and the kinematic structure of physical space can come apart, then scrambled worlds are physically different from their unscrambled counterparts

(6) Scrambled worlds are not physically different from their unscrambled counterparts

(2) Therefore, physical space cannot undergo transworld variation in terms of the laws that it sustains.

Since I find this argument for (2) sound, I conclude that Foster's modal argument is eminently defensible if we assume that spatiotemporal position is a categorical property. We saw earlier that denying that assumption exposes the physical realist to Robinson's case for idealism. So treating spatiotemporal position as a categorical property is not a very good move against Foster's modal argument.

Physical realists can make two moves, as far as I can see. The first is to adopt the position that Barry Dainton calls "geometrical pluralism:"

> [I]f a genuine space is *not* restricted to a single geometry – if *geometrical pluralism* obtains – we have the option of regarding the divergent [kinematic vs primitive] geometries [...] as belonging to one and the same space. If a case for pluralism can be sustained, realism can be restored without rejecting the other essentialist doctrines that Foster's argument requires. (Dainton 2010: 262)

The gist of this suggestion is that real space can have two different structures, a kinematic structure and a primitive metric structure, both of which are *physical* features of space. And using this idea, the physical realist can resist Foster's modal argument in two different ways. She can say that both the kinematic structure and the primitive metric structure of space are contingent features of space. Or she can say that both the kinematic and the primitive metric structure are essential features of space. On the first view, Foster's Principle of Constancy is false, and on the second, the Principle of Variability is false.

I believe that geometrical pluralism can be resisted by considering a realist variant of one of Foster's other deviant scenarios, the case where two distinct phenomenal spaces are realized by a single real space (Foster 1982: 153–4, cf. Dainton 2010: 256). Suppose we have a 3-dimensional kinematic structure which is realized by two bounded 3-dimensional primitive geometrical spaces, with objects passing from the first primitive geometrical space to the second when they reach the (physically undetectable) edge of the first one. In this case, it is highly implausible to claim that what we take to be physical space has two distinct geometries, one based on kinematics and one on the primitive metric relations. There is no single space that has both a kinematic and a primitive metric structure in this scenario.

The physical realist can reply that such extreme possibilities do not threaten geometrical pluralism as long as we have a single real space where the kinematic structure and the primitive metric structure mismatch to some degree. But this reply seems unsatisfactory because it is conceivable that the same kinematic structure is realized by a single real space in one world and by two distinct spaces in some other world. If the kinematic structure is not a feature of real space but a separate structure in the second case, it is hard to see why we should take it to be a feature of real space when we lower the number of its realizers.

Aternatively, the physical realist can resist Foster's argument by adopting nomic necessitarianism, the view that the laws of nature are metaphysically necessary. That would make the Principle of Variability false. But this move is unmotivated unless we have independent reasons to believe in the necessity of laws. Since the modal status of laws a substantive issue in its own right, I leave it unexplored here. I only note that I don't find the purported benefits of denying nomic contingency worth the loss of all the myriad ways in which counterlegal worlds figure in scientific and philosophical thought.

2.3.2 The abductive argument against spatial realism

Foster's second argument against spatial realism is based on an important principle that Foster calls "the principle of representation":

> [T]he physically relevant structure of the underlying external reality is that structure under which the reality is empirically represented at the human viewpoint—that structure under which the reality is disposed to reveal itself […] through the constraints on human experience. I shall call this the *principle of representation*. (Foster 1982: 212)

Foster argues, on the basis of this principle, that real spacetime is an irrelevant posit which, by inference to the best explanation, can be discarded:

> [T]he constraints [on experience], on their own, suffice for the creation of the physical world, irrespective of what (if anything) lies behind them

> […]. [I]f there is an external reality, it contributes nothing to the existence of the physical world save what it contributes to the obtaining of the constraints […]. [A]ny alteration of the external reality which makes no difference to the constraints makes no difference to the physical world, or, indeed, to the total physical reality comprising both the physical world and the psychophysical laws. (op.cit. 208)

As I understand it, Foster's abductive argument has the following shape:

(7) It is possible that the apparent space, and not real space, is physical space.

(8) If it is possible the apparent space, and not real space, is physical space, then it is necessary that apparent space is physical space.

(9) Therefore, physical space isn't real.

Premise (7) is supported by a type of deceptive possible worlds one might call "gappy worlds" (Foster 1982: 217–8). Suppose that the region where this room seems to be does not exist. Due to an aberration in the structure of spacetime, the walls of the room touch one another from the inside, so that there is nothing inside. The illusion that there is a room here is due to an irregularity in the way we represent reality. When we approach the doorway, we have the experience as of entering a room, but in reality, we slow down and stop, entering a hallucinatory state. Gappy worlds are conceivable, and there is no reason to deny that they are impossible. So (7) is justified: it is possible for the real and apparent structure of spacetime to come apart.

Foster (1982: 220–23) supports (8) by asking us to consider a series of gappy worlds where the gap gets bigger and bigger. Suppose that W_0 looks like our world and is gap-free, W_1 is a world where there is a small gap (e.g. the region where this room seems to be does not exist), W_2 is a world where there is a slightly bigger gap (e.g. the region where this building seems to be does not exist)… and so on. We may imagine, as a limiting case, a world W_∞ where no real space is left, and what we take to be the structure of spacetime is wholly ideal.

It is obvious that the real structure of spacetime is physically irrelevant in W_∞, because spacetime has no real structure there. Moreover, the real structure seems physically irrelevant in the higher regions of the series from W_1 to W_∞, because the real structure is so far removed from the apparent world there that it would not enter physical explanations even people knew about it.

Foster invites us to determine at which point between W_∞ and W_0 the real structure of spacetime becomes physically relevant. If the real structure is ever physically relevant, it surely is in W_0, where the real and apparent structures coincide. And since the real structure is physically irrelevant in W_∞, if the real structure is ever physically relevant, there must be a point between W_∞ and W_0 where it becomes physically relevant. Where is that point?

Foster argues that there is no good answer to this question, because there is no non-arbitrary criterion for claiming that, say, W_{297} (or a vague area around it) is the place in the series where the real structure of space suddenly kicks in and takes on some physical significance.

It might be objected that this reasoning is not different from standard sorites paradoxes. We don't know when baldness ends when we start plucking out hairs one by one, but it does not follow that there are no bald people. But Foster's argument is importantly different from standard sorites cases, I believe.

Consider the following analogy: Fantomas the supervillain has a special device that projects a false image of his head into everyone else's mind. Fantomas is completely bald, but whenever people look at him, photograph him etc., they see a person with a thick head of hair. Let's use some fancy terminology and say that Fantomas has two heads, a real one (which is bald) and an ideal one (which has thick hair). Fantomas's head, as far as everyone else is concerned, is his ideal head. Now suppose that Fantomas's hair starts growing. Slowly, his real head starts to look exactly like the image he projects into the external world. Even if there is perfect resemblance at some point, it is reasonable to say that Fantomas's head, as far as outsiders are concerned, is his ideal head, which does not become identical with his real head at any point during the process, even when the two are qualitatively identical. There are at least two reasons to think that the two heads are numerically distinct throughout.

One reason is that we acknowledged that Fantomas's ideal head and real head are two distinct things at the outset, when his real head is bald and his ideal head is hirsute. While his real hair was growing, we described the situation by saying that the real head was becoming qualitatively more similar to the ideal head. And it seems clear that what goes on, when Fantomas's hair becomes thicker and thicker and hence comes to resemble his ideal head perfectly, is *more of the same* process as before. And since what was going on before was a mere increase in qualitative similarity, more of the same means a further increase in qualitative similarity. The claim that this increase in qualitative similarity somehow spills over into identity at some point is unmotivated.

Another reason to think that Fantomas's real head and ideal head stay distinct throughout is that they have different modal properties throughout. Suppose that Fantomas has grown a lot of hair and so his real and ideal head are qualitatively the same. If Fantomas adjusted the device that projects his ideal head, so that the latter became bald, people would think that Fantomas has gone bald. But if he lost his real hair, people would not think that. So his real head and his ideal head have different modal properties even when they are qualitatively the same. This militates against the claim that the two are numerically identical.

This thought experiment shows that appeals to standard sorites cases do not defuse Foster's abductive argument. In standard sorites cases, we have a single entity that gains or loses some property during a process in which no sharp cutoffs are discernible. But in Foster's case, we have two entities which are supposed to merge into one. Appealing to standard resolutions of vagueness does not help here, because such resolutions would only help one establish that at some point, the two entities in question (viz. real and apparent space) become qualitatively identical. Standard resolutions of sorites cannot establish numerical identity.

2.4 Summary of Chapter 2

I have reconstructed three contemporary arguments for idealism. In 2.1 and 2.2, I focused on Howard Robinson's case for idealism, which consists of two parts, the Power Regress (an argument against entities without categorical features), and a refutation of physical realism from the conjunction of the Power Regress with the thesis that all known physical properties are dispositional. I defended a an epistemic variant of the Power Regress that entails that standard physical realism cannot be true if all physical properties are dispositions. I pointed out, however, that idealist applications of the Power Regress are open to the objection that spatiotemporal position is a categorical property. I also argued that positing unknown categorical bases that underlie physical dispositions is unwarranted in the present context.

Section 2.3 reconstructed two arguments against real space by John Foster. Section 2.3.1 focused on Foster's modal argument, the gist of which is that the physical realist must be committed to two contradictory principles, the principle of variability, which says that real physical spaces can sustain different laws, and the principle of constancy, which says that real physical spaces cannot sustain different laws. I argued that the principle of variability is entailed by the conjunction of two claims, the independently plausible hypothesis that laws are contingent and the defensible premise that spatiotemporal position is a categorical property. Following Foster, I argued that the principle of constancy is true because in cases where the kinematic and the primitive metric structure of a real space come apart, the primitive structure is physically irrelevant, and hence real physical space cannot be different than it is in a given world.

Section 2.3.2 reconstructed Foster's *abductive* argument, the gist of which is that real spacetime structure is an idle posit. The crux of this argument is the principle of representation, according to which the physically relevant structure of spacetime is the structure manifest in experience. We saw that this principle can be established by considering a series of worlds where the mismatch between the real and the apparent structure of spacetime becomes more and more severe, so that, high up in series, real spacetime structure is physically wholly irrelevant. I supported Foster's contention that there is no nonarbitrary criterion for saying that real structure becomes physically relevant somewhere in the lower regions of the series.

This chapter was meant to establish the following premises of my main argument:

(II) If physical objects are real, they have real categorical properties.

(III) The only categorical property of the particles and fields studied by fundamental physics is spatiotemporal position.

(IV) Spatiotemporal position is not a real property.

As discussed in 2.2.1, premise (I) is also warranted, given the aims and structure of the present defense of idealism:

(I) If physical realism is true, then the particles and fields studied by fundamental physics are real.

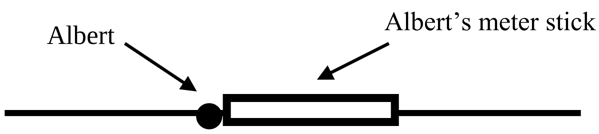
The rest of the dissertation tries to bolster the case for idealism that emerges when one puts these premises together. Chapter 3 offers a further argument in support of premise (IV), while Chapter 4 will address the complaint that idealism has such unwelcome features in terms of its ability to explain the structure of the physical world that it is better avoided even if premises (I)–(IV) are otherwise defensible.

3 Real spacetime as excess structure

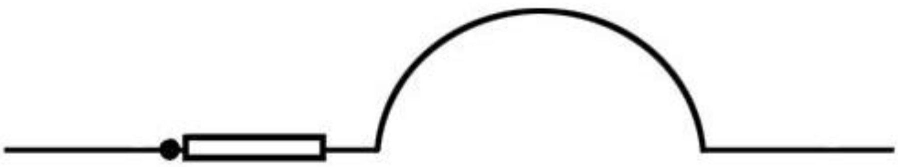
This chapter argues against real spacetime. In 3.1, I use a toy example to show how idealism can solve underdetermination issues about spatiotemporal structure and how it can motivate the view that real spacetime is a posit that makes one committed to metaphysically useless excess structure. In 3.2–3.4, I deploy this strategy in the context of a puzzle about relativity. Specifically, I'll argue that the puzzle of the conventionality of distant simultaneity is easily solved by idealism along the lines sketched in 3.1, but it has no straightforward and uncontroversial physical realist solution. I'll also indicate that idealism promises to deliver further similar results, hence, by inference to the best explanation, we may conclude that spacetime is not real but ideal.

3.1 Albert the ant

Albert is an extensionless ant who lives on a line. He can see and touch things on the line, he cannot see or touch anything above or below the line, and he cannot perceive changes in his vertical position. He has a meter stick that he drags around with himself, measuring lengths and distances:



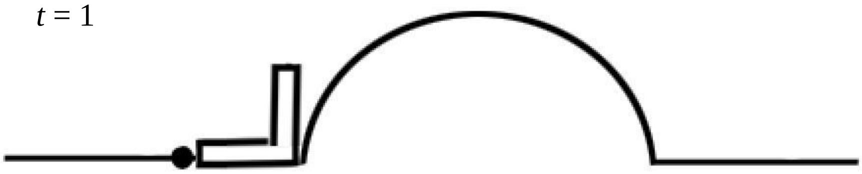
At certain places, there are humps on the line where Albert lives:



Albert, being confined to his own one-dimensional perspective and unable to perceive vertical changes in his position, cannot be directly aware of these humps. (It is consistent with this assumption that Albert can entertain the *idea* of unperceivable humps. He just happens to be unable to perceive the humps. As we'll see, the question is precisely whether he has any reason to think about his world in terms of unperceivable humps.)

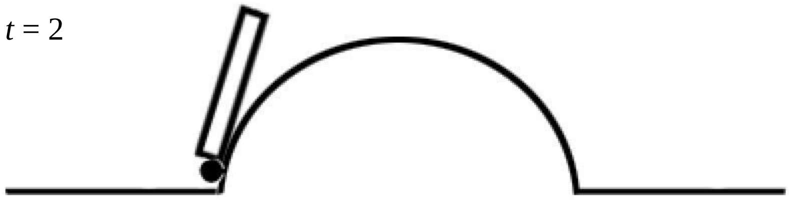
Suppose, further, that the physical laws in Albert's world are such that whenever Albert reaches a hump, his meter stick starts oozing upward, its far end disappearing from Albert's sight:

t = 1



Then, as Albert mounts the hump, the stick forms a tangent, touching the hump at a single point only:

t = 2



As Albert travels along the hump, the stick continues to form a tangent to it:

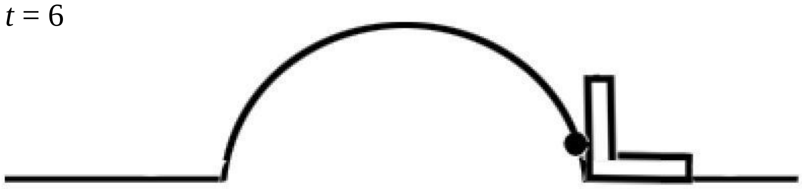
t = 3

t = 4

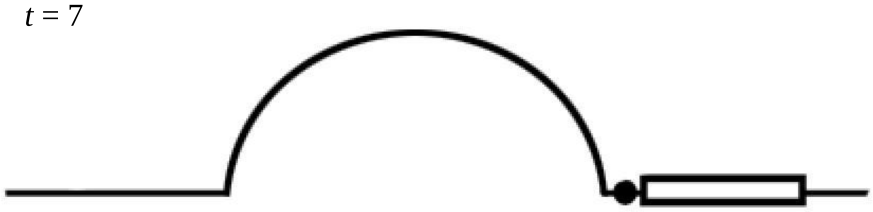
t = 5

Finally, when Albert is near the far end of a hump, the stick oozes down on the far side, regaining its original shape and orientation:

t = 6

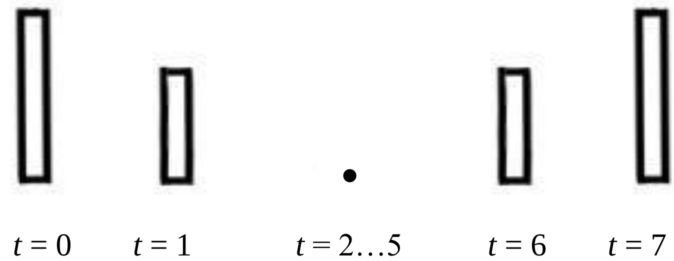


t = 7



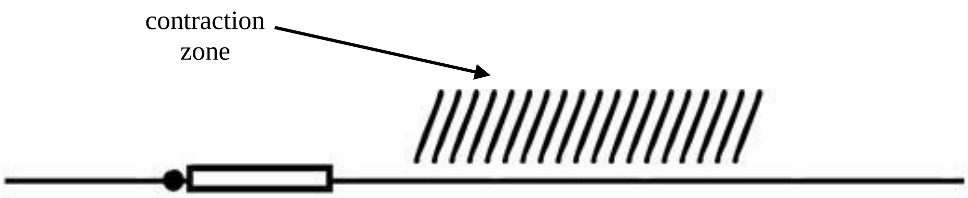
Now let's see what this process looks like from Albert's perspective. Since Albert cannot experience elevation and curvature (he is unaware of the second, vertical spatial dimension), he has the experience as of moving in a straight line even when he is on the hump. But since parts of his meter stick disappear into the spatial dimension that Albert cannot perceive, Albert will none the less notice some change, namely, he'll see the meter stick first shrink to a point, then grow back to its original size:

Albert's perception of the meter stick:



As far as Albert's experience as a one-dimensional surveyor is concerned, the humps in his world appear to be zones where meter sticks shrink to a point, then gradually regain their normal size.

Let's call the world we've discussed so far "world *A*." And let's consider a slightly different world *B*, which is much like *A*. *B* includes Albert, his meter stick, and a line where Albert lives. The only difference is that at the places where *A* contains humps, *B* contains *contraction zones*:

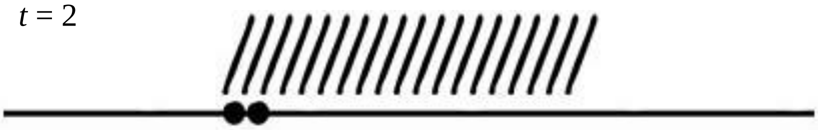


A contraction zone is a segment of the line where meter sticks get distorted because of a force field. When Albert pushes a meter stick into a contraction zone, the stick starts shrinking, hovering at the border of the zone:

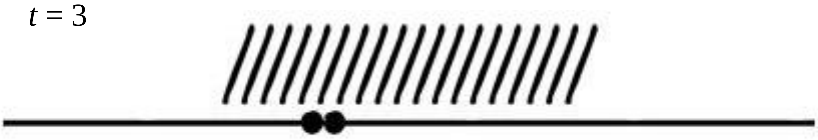
t = 1

When the stick has shrunk to a point, it finally enters the contraction zone, and it stays contracted to a point throughout the zone:

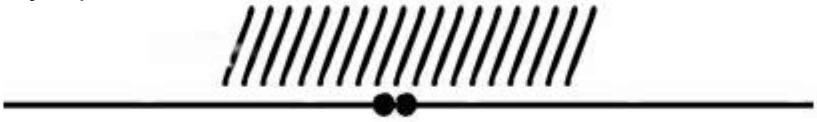
t = 2



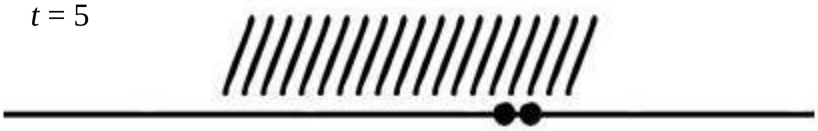
t = 3



t = 4



t = 5



Finally, when Albert is about to leave the contraction zone, the stick starts growing again, regaining its original size the moment Albert leaves the zone:

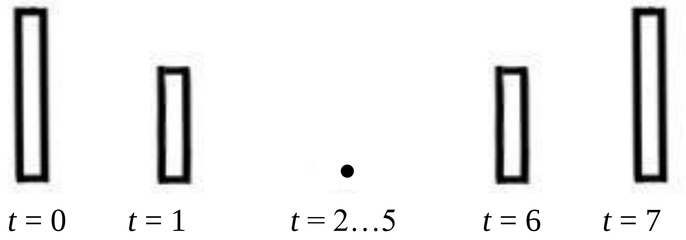
t = 6

t = 7

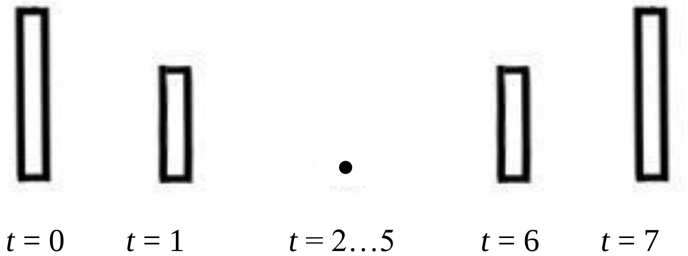
Let's compare Albert's experiences in the two worlds:

Albert's perception of the meter stick:

World A (containing humps)



World B (containing contraction zones)



As far as Albert's visual experience of the meter stick is concerned, he could just as well be in world *A* as in world *B*. Now consider two cases:

Case 1

In Albert's world, space is real.

Case 2

In Albert's world, space is ideal.

If Case 1 obtains, then it is to be expected that world *A* and world *B* are two different possible worlds, both of which could be Albert's world, as far as he can tell on the basis of experience. There seems to be a clear difference between worlds that contain humps like *A* and worlds that do not, so *A* and *B* must be different worlds. And since Albert cannot tell the difference between *A* and *B* on the basis of experience, he could be in either of the two worlds for all he knows, no matter which world he is actually in.

If Case 2 obtains, the humps in the first series of pictures do not correspond to anything real. Moreover, worlds *A* and *B* contain the same concrete facts in this case, since they contain experiences of the same phenomenal character. Those features that are supposed to distinguish *A* from *B* (e.g. that some line segments have nonzero curvature in *A* and zero curvature in *B*) are not observable by Albert, and since physical facts entail observability in idealism, there will be no facts of the matter about the features in question in idealism. It follows that in Case 2, world *A* and world *B* are the same world. The pictures depicting *A* and *B* (and the corresponding mathematical models that Albert might use to predict his future experience) are different representations of the same underlying (phenomenal) reality. Both representations correctly predict future experience, and neither is an actual *picture* of reality. The humps and contraction zones in the pictures are mere mental aids. Albert is free to choose the representation he likes best if he wants to formulate the laws of nature.

It follows that idealism can get Albert out of an epistemological quandary. If Albert's space is ideal, then Albert will know what the real structure of his world is (since, in that case, real structure is the structure of experience). In contrast, if Albert's space is real, Albert is faced with an underdetermination problem that he can only solve by appeal to epistemic luck or by reverting to pragmatic considerations (e.g. by choosing the model that seems more simple or convenient or aesthetically pleasing).

This toy example is meant to illustrate two things. First, it is meant to show how an idealist can turn puzzles about empirically equivalent theories into arguments for idealism. Whenever one is faced with a choice between two empirically equivalent physical theories, the idealist might have a chance to argue that, on her view, the alternatives in questions are just ways to represent the same facts about experience, and, as such, they do not constitute an epistemological dilemma any more than the choice between orthogonal and spherical coordinates constitutes an epistemological dilemma.

Second, by the same token, the idealist can argue that physical realism makes one committed to excess structure that creates epistemological trouble without explaining anything. For example, realism about Albert's space makes one committed to real facts about the curvature of Albert's line. This excess structure is necessary to secure realism, but it introduces an inscrutable component into Albert's world without doing any other work.

To sum up, if Albert's case can be treated as a paradigm, then idealists can argue that physical realism is unfavourable on two counts, first because it makes the structure of reality partly inscrutable, and second because physical realism clutters physical ontology with useless excess structure.

The toy example also indicates how physical realists can resist this type of reasoning. The best counter-move for physical realists is to insist that there is no physical difference between the rival models in question. In Albert's case, the physical realist should argue that there is no difference between forces that distort measuring instruments and variations in the curvature of space.

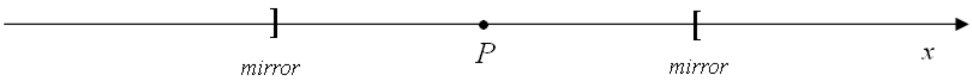
Needless to say, none of this is meant to be a real *argument* for idealism. The goal of the following sections is to explore a puzzle from the philosophy of relativity and to argue that it can motivate a similar case for idealism in the context of actual physics.

3.2 The conventionality of simultaneity

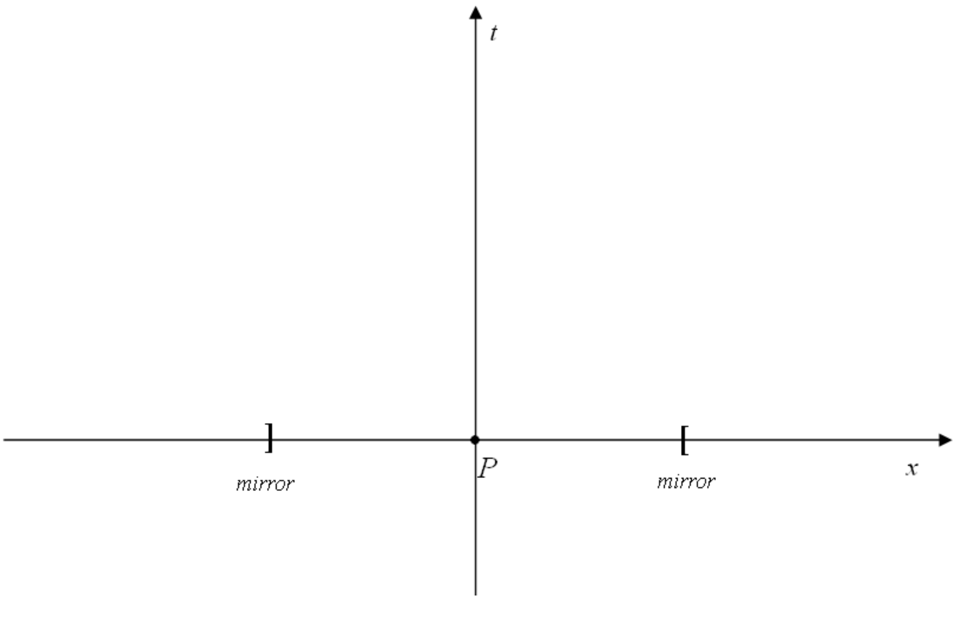
The following sections explore a strange and recalcitrant puzzle from the philosophy of relativity. The puzzle is called "the conventionality of (distant) simultaneity." Briefly, the problem is that special relativity seems compatible with observation-transcendent hypotheses about variations in the speed of light. Specifically, it seems compatible with the claim that the speed of light varies in different directions but the discrepancies even out. The present section explains the details of this puzzle. Section 3.3 surveys physical realist solutions. I'll argue that the puzzle has no straightforward and uncontroversial physical realist solution. Section 3.4 outlines the idealist solution. I'll argue that it is much more satisfying than physical realist ones, hence the conventionality of simultaneity can motivate the view that spacetime is ideal.

3.2.1 Measuring the one-way velocity of light

Suppose that the space of an observer is single line, with the observer standing at point *P* and two mirrors positioned on both sides at unit distance:

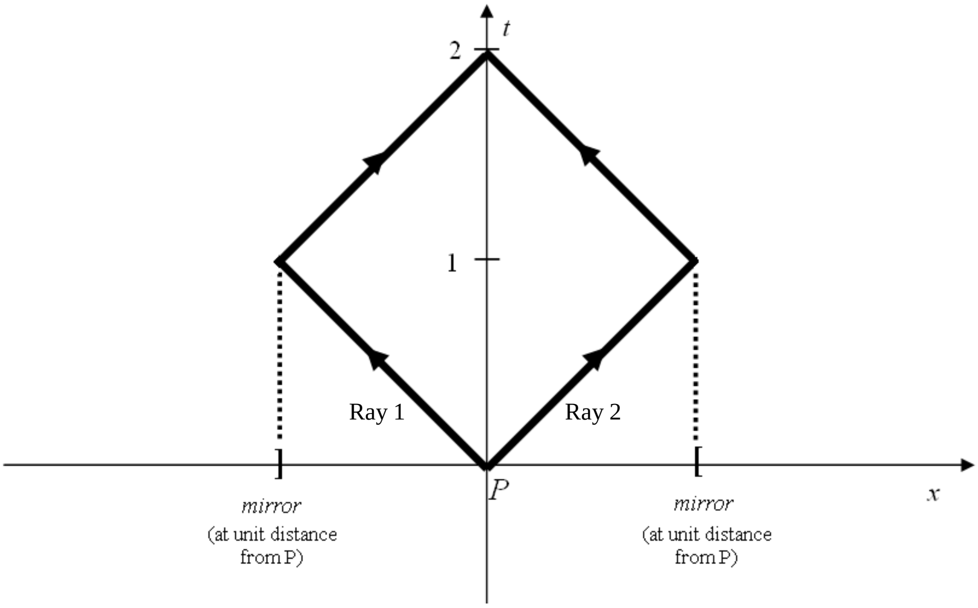


Now let's add a time axis to generate a two-dimensional spacetime:

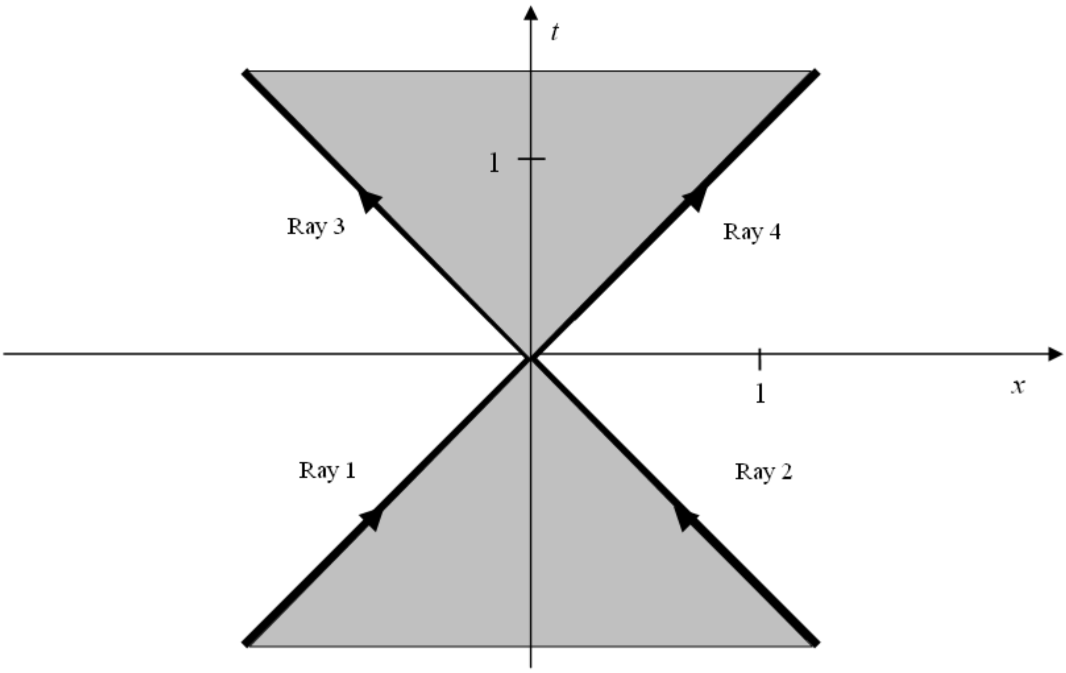


A line in this coordinate system represents both the spatial trajectory of an object and the times at which it visited a particular place. For example, the spatiotemporal trajectory of the observer stationed at *P* is represented by the *t* axis. Points in the diagram represent momentary events at a point in space. For example, each point on the *t* axis "is" the place *P*, but at different times. We can think of these points as momentary events.

Suppose we choose our unit distance to be *c* meters, so that the speed of light (on the standard conception) is 1 unit distance per second. With this convention in place, the spacetime trajectory of two light rays, emitted from *P* at $t = 0$ toward the mirrors on each side, will look like this:



Generally, the path of light rays traveling to or from *P* will be represented as lines tilted at 45 degrees to the *x* axis:



Rays 1 and 2 travel towards *P* from a distant source, reaching *P* at $t = 0$. Rays 3 and 4 travel from *P* toward some distant target, leaving *P* at $t = 0$. (Perhaps Rays 3 and 4 are Rays 1 and 2, crossing at the origin or reflected back toward their respective sources.)

The shaded area enclosed by the four rays is called the *lightcone* of the origin (the origin itself being the momentary event occurring at *P* at $t = 0$ in the stationary observer's frame). Every point in the diagram has its own lightcone. A lightcone is the collection of those point-events that can be causally connected to the point whose lightcone they constitute. In the previous picture, Rays 1 and 2 represent the "outermost" points that can causally influence the point-event at the origin, and Rays 3 and 4 represent the "outermost" points that can be causally influenced by the point-event at the origin. If a point from outside the shaded area were causally connected to the origin, then the causal influence would have to propagate faster than light, which is impossible in special relativity.

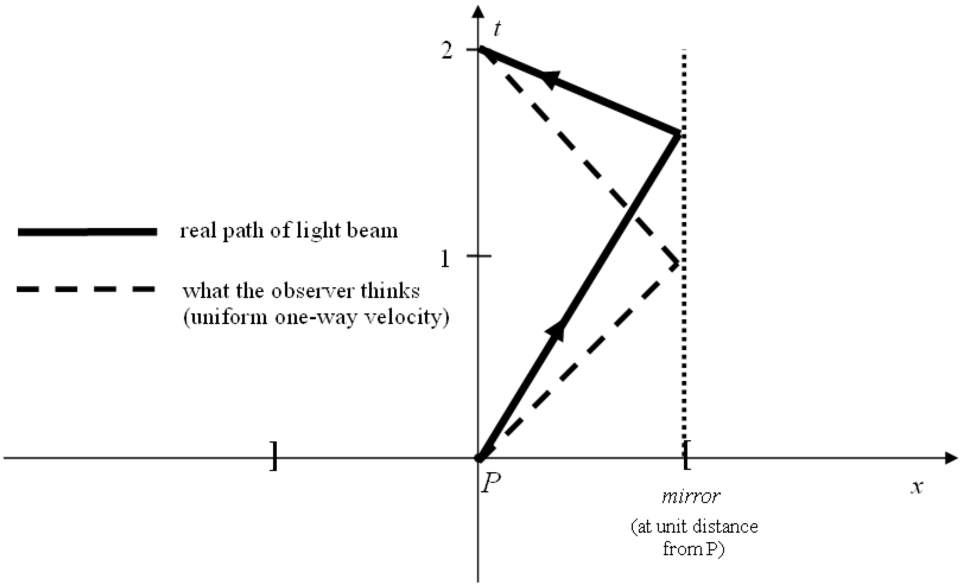
An important premise of relativity is that the velocity of light is the same for all observers, whatever their relative motion (Einstein 1923: 41, 2005: 78).[25] This idea marks a radical departure from Newtonian physics, where the apparent velocity of objects varies with the velocity of the observer. If Superman is flying at 599 mph, chasing a plane that is flying at 600 mph from the standpoint of a stationary observer, then, in Superman's frame of reference, the plane will crawl at 1 mile per hour. This logic applies to relative velocity across the board in classical physics. But in relativity, a light beam traveling at *c* from the point of view of the stationary observer will also travel at *c* from the point of view of Superman (and everyone else). The invariance of the speed of light results in well-known oddities like time dilation and length contraction. It also entails that all observers will agree on the shape and position of the light cones, hence the basic structure of the causal order will be objective.

Now consider the following problem. The observer at *P* wants to measure the speed of light. A seemingly straightforward way to do this is to send out a light beam from *P* at $t = 0$ toward one of the mirrors, and record the time, *T*, when the beam, reflected back from the mirror, returns to *P*. Dividing 2 by *T* then gives us the velocity of light, since the light beam traveled 2 units of space in *T* units of time. Given that we chose our metric unit to be *c* meters, we expect $2 / T$ to equal 1, that is, we expect the round-trip to take 2 seconds.

Notice, however, that if the observer is confined to *P* and this experiment is her only means of measuring the speed of light, then she cannot be sure that light travels with the same velocity to the mirror and back. The observation that it takes light 2 seconds to make the round-trip is compatible with the hypothesis that, say, the speed of light toward the mirror is $0.625c$ and its speed back is $2.5c$. In such a case, it will take the beam 1.6 seconds to reach the mirror and 0.4 seconds to come back, so the round-trip will take 2 seconds, just as in the nondeviant case where the speed is the same in all directions.

[25] The second basic principle of relativity theory is that observation and experiment leads to the same formulation of the laws of nature in all frames of reference. This principle will not be important in the present dialectic.

If, in fact, light travels at 0.625c to the right and at 2.5c to the left, then the spacetime diagram of the experiment will look like this:



A nondenumerable infinity of such deviant scenarios are compatible with the observed fact that it takes light 2 seconds to bounce back from the mirror. In principle, each point on the dotted line could be the event of the beam's hitting the mirror. Hence, a lonely observer who is confined to P and can only use mirrors (or other distant objects that "signal back") cannot measure the one-way velocity of light. She can only tell that the average round-trip velocity is c m/s (in vacuum, at any rate—let's ignore this).

What is interesting about this problem is that the deviant scenarios sound trivially easy to disconfirm once we discard the unreasonable hypothesis that we have a single observer who is confined to P. But, surprisingly, the problem at hand has no easy solution. It is one of the most recalcitrant puzzles in the philosophy of relativity, one that continues to generate controversy, more than a hundred years since it was discovered by Einstein.

To see why the one-way velocity is not easy to measure, suppose we discard the unreasonable assumption that the observer is confined to P and can only use mirrors. Suppose we have two clocks instead, one at P and one at $x = 1$. The observer at P sends out a light beam at $t = 0$, and the clock at $x =1$ (or a second observer who has access to the distant clock) records the time, T, when the beam arrived. Dividing 1 by T, we have the one-way velocity of light.

To make this experiment work, the two clocks must be synchronized: we must have good grounds for saying that the second observer's clock read "0" (or some other known value) when the light beam left P. Otherwise the readout on the second clock won't tell us how long it took light to traverse unit distance, because we will have no grounds for saying that when we released the light beam at $t = 0$ from P, the second clock read "0" (or some other known value).

Let clock *A* be at *P* and clock *B* at $x = 1$. We connect the two clocks by a wire. Before launching the light beam, we send an electric signal from *A* to *B*, setting *B* to a known value that guarantees that the two clocks both read "0" when the light beam takes off from *P*. Then the readout on *B* will give us the time it took light to traverse unit distance.

To guarantee that clock *B* reads "0" when the light beam leaves *P* at $t = 0$ (on *A*'s time), we have to know exactly how long it takes for the synchronizer signal, sent from *A* to *B*, to reach clock *B*. Instantaneous signaling is impossible in relativity (because nothing can travel faster than light), so the synchronizer signal will take some time to reach *B*. Suppose it takes *S* seconds. Then we have to send the synchronizer signal at $t = –S$ (on *A*'s time), telling *B* to set itself to 0, if we want the two clocks to read "0" at the same moment.

The trouble is that if we use electric or radio signals, then the magnitude of *S* will depend on the speed of light, since the speed of light is intimately involved in such phenomena.[26] So we cannot use this method to synchronize two distant clocks to measure the velocity of light from *A* to *B*, because we must already know the one-way speed of light to synchronize the two clocks. We'll have to know the constant we want to measure prior to measuring it.

Note, further, that if we arbitrarily choose an admissible value for the one-way velocity, then our measurements will not detect an anomaly even if there is one. For simplicity, suppose we use radio signals that travel at the speed of light, and suppose that in reality, light travels at 0.625*c* to the right and at 2.5*c* to the left. Our observer assumes uniform velocity, so she believes that it will take light 1 second to travel from clock *A* to clock *B*. At $t = –1$ (on *A*'s time), the observer sends out a signal that tells clock *B* to set itself to 0. The observer reckons that the signal will hit *B* the moment *A* reads 0, so both clocks will read "0" when the light beam leaves *A*.

Let's see what happens in reality. In reality, the synchronizer signal travels at 0.625*c* from *A* to *B*, so it reaches *B* in 1.6 seconds. Since it is sent at $t = –1$ (on *A*'s time), *B* will read "0" when *A* reads "0.6."

Meanwhile, the light beam whose one-way velocity is being measured is emitted when *A* reads "0." This beam also takes 1.6 seconds to arrive to *B*, so it hits *B* when *A* reads "1.6." But *B* is running 0.6 seconds late in comparison to *A*, so *B* will read "1" when the light beam hits it. Hence, when the observer, or her buddy, checks the second clock, she'll think that it took light 1 second to travel unit distance, and she'll figure that the one-way velocity of light is *c* m/sec. The difference between this value and the real one will be undetectable, because an incorrect assumption about the result is already built into the synchronization method and the mistakes even out.

[26] See Torretti (1979: 303) for a note on how deviances in the one-way velocity affect the laws of electrodynamics.

It follows that remotely synchronized clocks cannot help us determine the one-way velocity of light.[27]

Suppose we do the following instead: We set two clocks side by side at *P*, and we synchronize them locally. Then we transport clock *B* to $x = 1$, and, when *A* reads "0," we send a light beam to *B*. Since the two clocks are already synchronized, the readout on *B* will tell us the one-way velocity.

The problem with this idea is that special relativity predicts that moving clocks slow down. Hence, when we move clock *B* from *P* to the measurement post, clock *B* will show a different time than *A* upon arrival. The slowdown depends on the velocity of light, so we'll have to make an assumption about the one-way velocity to correct for the slowdown. And if we make an incorrect assumption, our setup will be mucked up in such a way that we'll end up measuring *c* for the one-way velocity even if it isn't. (See Appendix.)

To sum up, there is no easy way to find out whether light travels with the same speed in all directions. In his seminal paper on special relativity, Einstein claimed that we simply *stipulate* that the one-way speeds are uniform:

> If at the point *A* of space there is a clock, an observer at *A* can determine the time values of events in the immediate proximity of *A* by finding the positions of the hands which are simultaneous with these events. If there is at the point *B* of space another clock in all respects resembling the one at *A*, it is possible for an observer at *B* to determine the time values of events in the immediate neighbourhood of *B*. But it is not possible without further assumption to compare, in respect of time, an event at *A* with an event at *B*. We have not defined a common "time" for *A* and *B*, for the latter cannot be defined at all unless we establish by definition that the "time" required by light to travel from *A* to *B* equals the "time" it requires to travel from *B* to *A*. (Einstein 1923: 39–40)

The thesis that the one-way velocity of light is a matter of convention entered the philosophy of science through Hans Reichenbach's (1957 [1927]) landmark interpretation of relativity theory, and it entered English-language philosophy of science through Adolf Grünbaum's (1955, 1963) endorsement of Reichenbach's claims.[28] The thesis is usually known as "the conventionality of (distant) simultaneity." It has been a subject of controversy ever since.

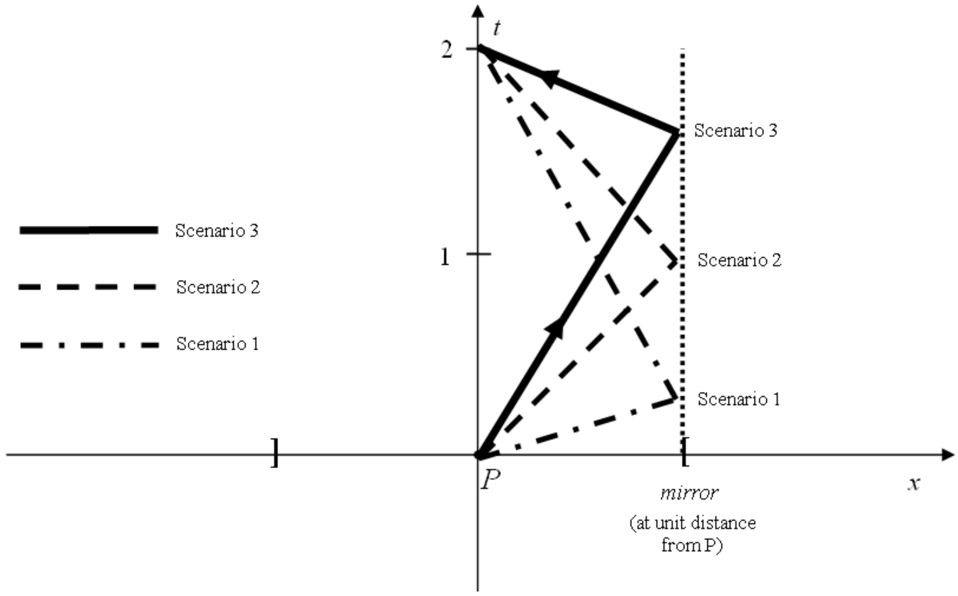
[27] A similar masking effect occurs if we try to use two-way synchronization, letting clock *B* tell clock *A* when it received the synchronizing signal. As long as the round-trip average velocity is *c*, discrepancies in the one-way velocities will be undetectable.—Notice that, properly speaking, the length of time units must also be synchronized in order for two clocks to beat the same time (see Einstein 1993 and Jammer 2006: 124–5). Factoring this in would also involve clock *B* signaling back to *A*.

[28] See Reichenbach (1957: §19, 123–7) and Grünbaum (1955, 1963: 341–68) for two classic expositions, and see Jammer (2006: Chs. 9–10) on the history of the puzzle.

3.2.2 Consequences of deviance

In the last hundred years or so, various deviant models of special relativity have been proposed, models where the speed of light is not uniform. One of the most famous is John A. Winnie's (1970), which applies to the kind of 2D spacetimes that we are considering. There are more general models as well, all of which are claimed to generate the same observable predictions as models where the speed of light is uniform.[29] The goal of this section is to present some basic non-technical consequences of the assumption that the one-way speed of light is not uniform.

First of all, to see why the problem at hand is called "the conventionality of simultaneity," consider three possibilities about the one-way speed of light:



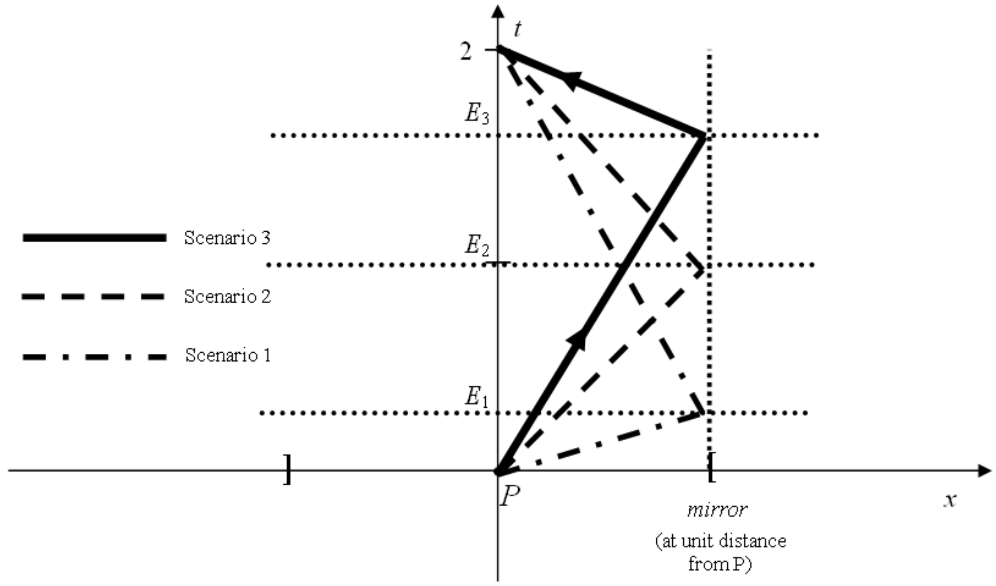
The three scenarios agree that the average round-trip velocity of light is *c*, i.e., that it takes 2 seconds for the beam to come back. (Remember that the diagrams use *c* meters as the unit of distance.) But the three scenarios disagree on the one-way velocity.

Scenario 2 represents the standard (nondeviant) assumption that it takes light the same amount of time reach the mirror and come back. Graphically, this means that the moment when the beam is reflected back is halfway on the dotted line, coinciding with $t = 1$ on the *P*-observer's clock.

Scenarios 1 and 3 are deviant. In Scenario 1, light goes much faster than *c* to the right and much slower than *c* to the left, so that the moment of reflection occurs comparatively early (earlier than $t = 1$) on *P*'s clock. In Scenario 3, it is the other way around: light travels slower than *c* to the right and faster than *c* to the left, so the moment of reflection occurs later than $t = 1$ on *P*'s clock.

[29] For a sample of nonstandard models of special relativity where the one-way speed of light is not uniform, see Scott-Iversen (1944), Edwards (1963), Winnie (1970), Abraham (1986), Minguzzi (2002), and Ben-Yami (ms).

The three scenarios, therefore, disagree not only on the one-way velocities, they also disagree on which moment in *P*'s local history (i.e. which point on the *t* axis) is simultaneous with the light beam's hitting the mirror:



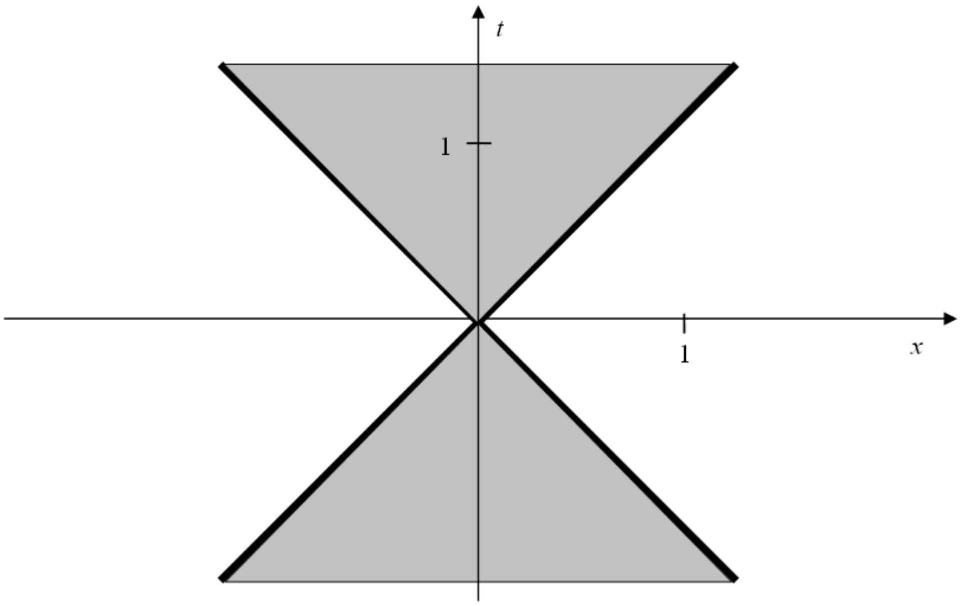
If Scenario 1 obtains, then the moment when the light beam hits the mirror (the moment of reflection) is simultaneous with E_1 (which is a point-event in the local history of the observer at *P*). If Scenario 2 obtains, the moment of reflection is simultaneous with E_2 (which is a different point-event in the local history of the observer at *P*). If Scenario 3 obtains, the moment of reflection is simultaneous with E_3 (which is, again a different event).

Now suppose that, as Einstein implied and as Reichenbach and Grünbaum explicitly argued, it is a matter of convention whether we assume the one-way speeds of light to be uniform or deviant. Then it is a matter of convention which one of the these three scenarios obtains. And, consequently, it is a matter of convention which one of E_1–E_3 is simultaneous with the moment of reflection. The observer at *P* can simply stipulate which moment in her local history is the moment when the light beam hits the mirror at a faraway point. (Within certain limits, of course. But as the diagram shows, these limits are considerably wide.)

This is why the problem at hand is called "the conventionality of (distant) simultaneity." If the one-way velocity of light is conventional, then it is a matter of convention when distant events occur according to my local time. And, conversely, if this is a matter of convention, then the one-way velocity of light is also a matter of convention.

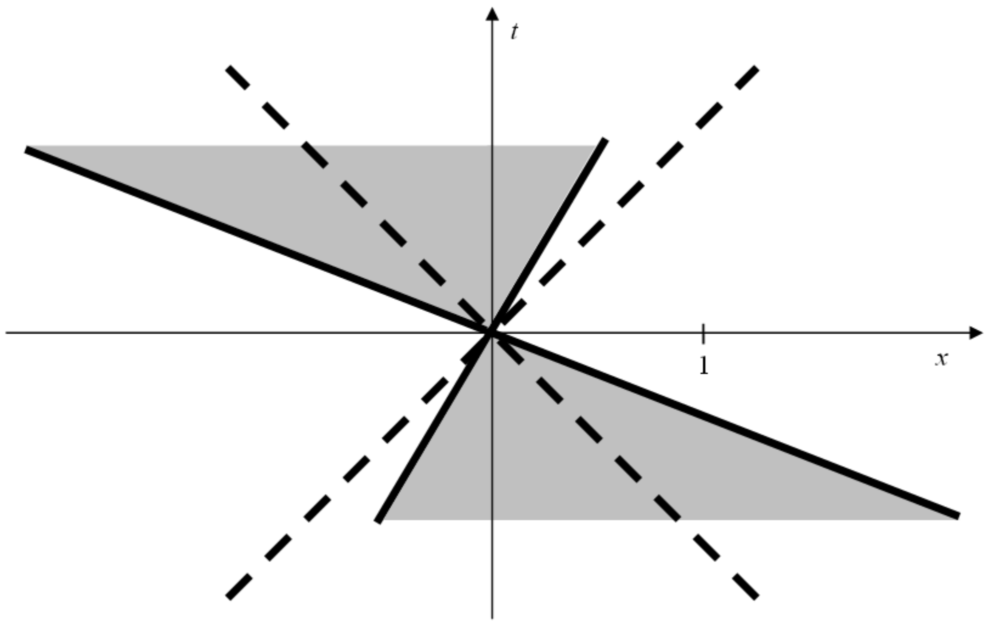
It seems profoundly unintuitive to think that there is no fact of the matter about these relations and that it is a matter of definition (or convenience, or theoretical elegance) whether light moves with the same speed in all directions. The existence of deviant models has therefore spurred various theories that seek to undermine them or downplay their importance. Before looking at these attempts, let's see a further important consequence of deviance.

Variations in the one-way velocities of light will also affect the shape of light cones. The light cone of the origin (that is, the collection of points that can be causally connected to the origin) looks like this in the standard case when the one-way velocity of light is uniform:



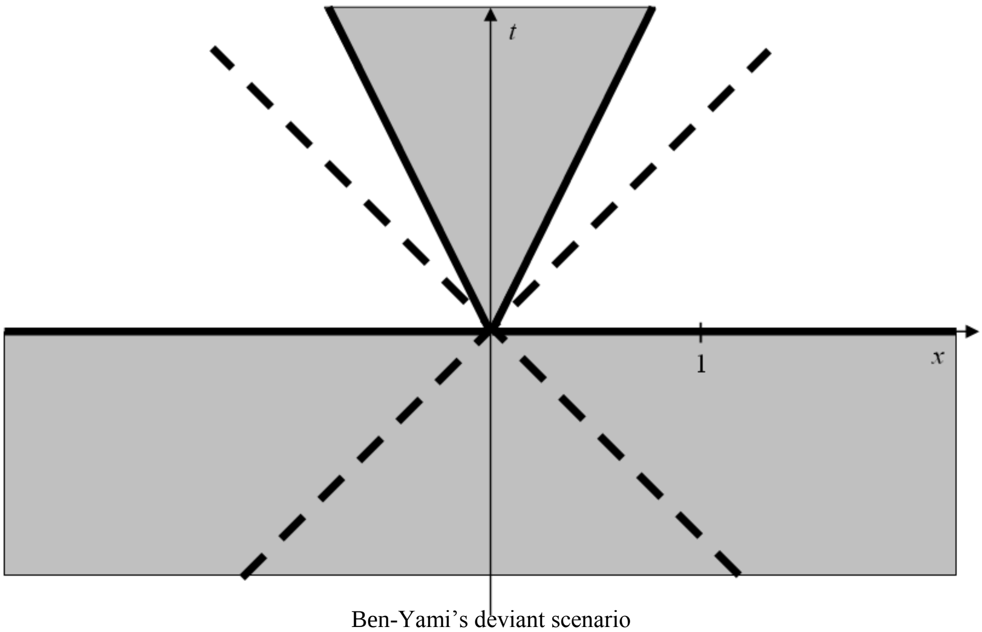
Uniform one-way velocity (Scenario 2)

If the one-way velocities are not uniform, the light cone will take a different shape. For example, if light goes faster to the left than to the right (with the two velocities adding up to the theoretically required round-trip speed of *c*), then the light cone of the origin will look like this:



Deviant case: different one-way velocities
(Scenario 3: Light travels at ~0.625*c* to the right
and at ~2.5*c* to the left)

Hanoch Ben-Yami (ms.) constructed a deviant model of special relativity where the difference from the standard case is even more striking, and the light cone of the origin looks like this:



Ben-Yami's deviant scenario
(light travels at 0.5*c* away from the observer
and with infinite speed toward the observer)

The conventionality of simultaneity entails that the shape of light cones is also conventional. (In fact, they aren't necessarily cones any longer.)

The rest of this chapter falls into two parts. In 3.3, I look at various physical realist responses to the puzzle of conventionality and I'll argue that none of them is straightforward and uncontroversial. In 3.4, I'll outline the idealist solution, which, I'll claim, is straightforward and uncontroversial, giving a neat and satisfying explanation of the puzzle. I'll conclude that the conventionality of simultaneity can motivate the view that spacetime is ideal.

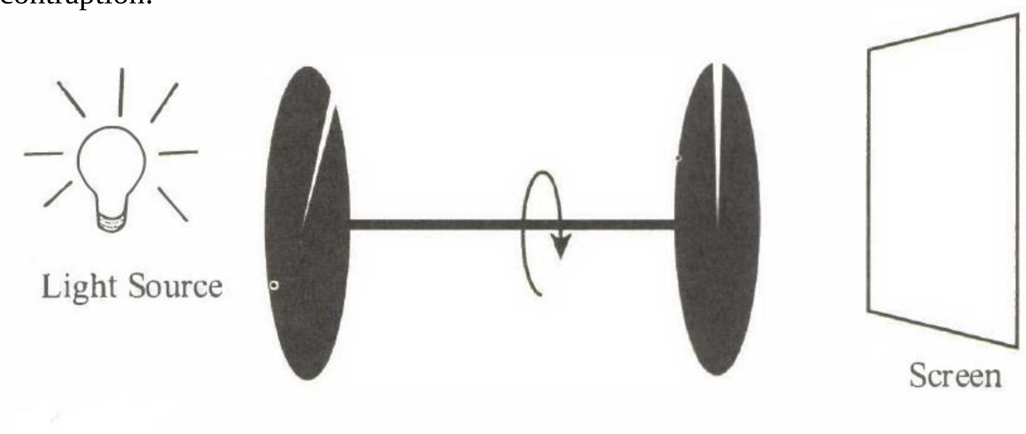
3.3 Physical realist solutions

This section surveys possible physical realist responses to the conventionality of distant simultaneity. Not all of the theories below entail physical realism, but, as far as I can see, they exhaust the spectrum of dialectical strategies that are compatible with physical realism.

3.3.1 Experimental tests

There is a venerable history of attempts to measure the one-way speed of light. As Max Jammer's (2006: Ch.12) detailed survey indicates, an assessment of all of these (apparently, failed) attempts is more of a physicist's job than a philosopher's. But it is useful to look at a specific example in order to appreciate the complexities involved.

Tim Maudlin (2012: 121–4) asserts that the one-way velocity of light can be (and has been) measured (and has been found uniform) using the following contraption:



Two disks, each with a slender slit on it, is fixed to the ends of a rod that can be rotated with a speed that we can control. A light beam is flashed from one side at the first disc. If the rod is rotating with the right speed, then the light beam getting through the first slit will reach the second slit when the second slit is at the position where the first was when light beam entered the area between the two discs, so light will get through the contraption and leave a mark on the screen on the other side. Otherwise, if the rod is set to rotate at a speed so that the beam entering through the first slit will fail to hit the slit on the second disc, no mark will appear. If we know the distance between the two discs, the speed at which they rotate, and the relative position of the two slits, then we can calculate what speed a light beam must have in order to leave a mark on the screen. Next, all we have to do is (i) set the rod to rotate at a speed such that light traveling at *c* will get through the second slit and (ii) turn the whole contraption in various directions. If light leaves a mark on the screen in all directions, then the one-way velocity of light is *c* in all directions.

As Max Jammer (2006: 224) explains, this test (which is a variation on an experiment performed by H. L. Fizeau in 1849) presupposes that the rod that moves the two discs is perfectly rigid. But that principle is false in relativity:

> The denial of actions at a distance, which were admitted in Newtonian physics, also denies the existence of perfectly rigid rods. The definition of perfect rigidity, as preservation of geometrical shape, implies that if one end of such a rod would be set into motion, the other end would instantaneously start moving as well, so that the rod could serve as a generator of actions at a distance. If perfectly rigid rods existed, the problem of distant synchronization could, of course, be solved simply by coupling clock mechanisms by such rods. In fact, numerous synchronization procedures, proposed to disprove the conventionality thesis, are but more or less disguised versions of such coupling proposals. (Jammer 2006: 222)

To measure the one-way velocity the way Maudlin suggests, one must suppose that if a motor starts turning one end of the rod, giving it a certain angular velocity, then the far end of the rod will start moving at the same instant, so that the two slits will stay in the same relative position during rotation that they occupied at rest. Knowing the relative position then lets us calculate the exact speed that is required for light to escape through the second slit. However, if the rod that moves the two discs is not perfectly rigid, then the discs do not start spinning at the same time, so the relative position of the slits changes. One must factor in these changes in relative position to know what speed light needs to escape through the second slit once the contraption has started opearting. But material forces (including the force that moves the rod) propagate at speeds that ultimately depend on the speed of light, hence in order to calculate the time lag between the moments the two discs start rotating, one must know the one-way velocity of light. So this contraption does not allow us to calculate the one-way velocity without making assumptions about it beforehand and thereby begging the experimental question.

Numerous other experimental setups have been proposed, a thorough survey of which would require a separate book filled with technical discussions in physics.[30] As the surveys by Jammer (2006) and Janis (2010) indicate, there is no clear sign of an emerging consensus. In the words of John Norton,

> The quest for the one way velocity of light is beginning to look like the quest for a perpetual motion machine, for in both cases the fruitlessness of the quest can be demonstrated by quite elementary means. […] [I]t reduces to the simple question of whether special relativity can be

[30] Here is a sample of proposed methods and conventionalist rejoinders, from Jammer (2006). Experimental setups using mechanical devices like the one mentioned by Maudlin have been proposed by Eagle (1938), Feenberg (1974), and Jackson and Pargetter (1977), among others. Øhrstrøm (1980), Torretti (1979), and Townsend (1980) argue that these methods are not convention-free. Stolakis (1986) discusses the possibility of measuring the one-way speed of light using refraction, but Clifton (1989) claims that this method isn't convention-free either. A number of authors (e.g. Burniston Brown 1967, Froome and Essen 1969: 3) say that the method that Ole Roemer used in the 17th century to measure the speed of light can give the one-way speed. Karlov (1970), Babovic et al. (1991), Shea (1998), and Jammer (2006: 230) argue that this method tacitly relies on the assumption of uniform speed. Essen and Gordon-Smith (1948), Bol (1950), and Liebowitz (1956) have proposed measurements using microwave resonance, but Grünbaum (1956) and Salmon (1977) argue that these methods are not convention-free. Ruderfer (1960) and Møller (1962) proposed to test the one-way velocity using laser or maser, but Sjödin (1979) and Podlaha (1980) claim to have showed that these methods cannot measure the one-way velocity. (Note that Ruebenbauer (1980) claimed to have found evidence for uniform one-way velocity using such a method, while Marinov (1974) claimed to have found evidence for non-uniform velocity.) Ellis and Bowman (1967) and Prokhovnik (1973) proposed transporting clocks at very slow speeds to get around the time dilation problem and create perfectly synchronized distant clocks. Grünbaum, Salmon, van Fraassen and Janis (1969), Friedman (1977), and Winnie (1970: 223–9), among others, have argued that this method either cannot detect deviances or it solves the problem by *fiat*, swapping one kind of convention for another. This list of proposed tests and conventionalist rejoinders is far from complete and most of the debates belong to physics proper. Nonetheless, this brief survey indicates that the testability of the one-way velocity is contentious at best.

> formulated in certain ‘ε-Lorentz coordinate systems’ rather than just the ‘Lorentz coordinate systems’ used in the familiar standard formulation of the theory. That this is possible has been known in principle since as early as 1913, when Einstein introduced techniques which would enable special relativity to be formulated in arbitrary spacetime coordinate systems. The quest for the ‘true’ value of ε [= the ratio between *c* and twice the ‘real’ velocity] and the (coordinate dependent) one way velocity of light which it determines, is as fruitless as the quest for the subset of ‘true’ coordinate systems in which special relativity can be formulated. For this task, all coordinate systems are equally viable. (Norton 1986: 119)

Given the long history of unsuccessful attempts to devise empirical tests for the one-way velocity, and given the opinion of notable philosophers of science that such tests can’t exist, the thesis that the one-way velocity of light is not an empirical issue seems defensible. I’ll assume, for the purposes of this dialectic, that the one-way velocity is either observation-transcendent, or it does not exist. The question for the rest of 3.3 is to find out how physical realists can cope with this situation.

3.3.2 Appeals to simplicity

Michael Friedman (1984: 156–76) thinks that the hypothesis of non-uniform one-way speed commits one to a physically irrelevant asymmetry that inference to the best explanation gets rid of easily. To see Friedman’s idea in a bit more detail, suppose that light goes faster to the right than to the left in a 2D spacetime, so that light cones are tilted to the right. Friedman argues that in such a world, a spatial direction is singled out as somehow unique, but this asymmetry (or, in technical language, anisotropy) has no physical significance whatsoever and does not do any explanatory work. Hence, those who worry about the one-way speed worry about a possible asymmetry that adds nothing substantial to our conception of the physical world except for making it more complex. Hence, the puzzle about the conventionality of simultaneity can be solved by a simple abductive inference.

Friedman’s argument has the following basic structure:

(Exp) Deviant models of relativity do not explain anything.

(Abd) Hypotheses that don’t explain anything can be disregarded.

∴ Hence, deviant models of relativity can be disregarded.

Now if we move in the context of *physics*, (Exp) is certainly true. Physics is concerned with prediction, and since deviant models are empirically equivalent to the standard one, variations in the one-way speed of light can have no explanatory role in physics.

However, if (Exp) is interpreted in this way, then it is a pragmatic point about physics and not a point about the metaphysics of spacetime. If a deviant model of relativity suddenly turned out to be more workable for certain calculations, (Exp) would cease to be true and physicists would be justified to switch to that model. But, presumably, Friedman does not want to say that the structure of spacetime would change as a result. Hence, the fact that variations in the one-way speed of light have no explanatory relevance in physics does not entail that the one-way speed of light is uniform.

In response, the Friedmannian can insist that her point is not pragmatic but ontological. We have reason to think that there are no arbitrary asymmetries in nature. Nature seems highly uniform, and physical laws are typically invariant with respect to time and place. Hence, we have reason to think that no arbitrary asymmetry affects the one-way speed of light, and, as a result, the argument from simplicity does have ontological consequences.

The gist of this reply is that deviant models of relativity contradict our best inductive principles. The Friedmannian, in effect, says that the deviant models represent sceptical scenarios that can be disregarded even if they are empirically equivalent to the normal case. The hypothesis that we are brains in vats is empirically equivalent to the hypothesis that we are normal human beings, but it does not follow that BIV worlds must be taken into account when we look for the most plausible ontology of the actual world. Or, to take an example from physics, consider epicycles in Ptolemaian cosmology. Ptolemaian cosmology can be made to be empirically equivalent with the heliocentric theory of Kepler at the price of adding more and more complexity. But it does not follow that Ptolemaian worlds are relevant when we consider the structure of the actual physical world. Similarly, worlds where the one-way speed of light is not uniform can be disregarded when we consider the ontology of the actual world, even if the former are empirically equivalent to our preferred standard theory.

In response, the anti-Friedmannian can say, first, that the way natural laws are distorted in deviant models is different from the way reality differs from our preferred simple theories in BIV worlds and in worlds where Ptolemaian cosmology is true. Deviant models of special relativity differ from our preferred simple theory in terms of the observation-transcendent value of a constant that is found in both standard and deviant models, playing the same theoretical role. So the difference between worlds where the one-way speed of light is uniform and worlds where it is not uniform is much smaller than the difference between BIV worlds and normal worlds or the difference between heliocentric worlds and observationally equivalent Ptolemaic ones. As a result, the fact that BIV worlds and Ptolemaic worlds can be safely disregarded when we investigate actual physical ontology does not entail that worlds where the one-way speed is not uniform can also be disregarded.

Moreover, the anti-Friedmannian can point out that even if the charge of skepticism is sound, it only secures the conclusion that the one-way speed of light is *actually* uniform. The Friedmannian admits that deviant worlds are metaphysically *possible*. But this fact is quite puzzling in itself, even if our actual hypotheses about the one-way speed are correct because of a piece of epistemic luck. Intuitively, it would much better to solve the puzzle by showing either that the deviant models are not consistent with actual laws or by showing that the difference between deviant and non-deviant models do not correspond to a real difference. Friedman's solution entails that, possibly anthropocentric appeals to symmetry aside, there is no reason why nature should care about the one-way speed of light, which seems to be a peculiar feature of physical reality. Friedman's solution only dispels the puzzle at an epistemic level (as a challenge to our knowledge of actuality), hence it is inferior to those solutions that dispel the puzzle at a metaphysical level as well.[31]

It might be objected that by rejecting simplicity-based solutions, the present argument for idealism weakens itself, for the following reason. In 2.3, I endorsed John Foster's arguments against real space, and I am presenting the puzzle of the conventionality of simultaneity as a challenge to physical realism that ties into Foster's case against real spacetime. However, Foster himself adopts a principle of nomological simplicity when he argues that in cases when the real and ideal geometry of spacetime come apart, it is the latter that encodes physical laws:

> It is nomological organization itself which selects the physical geometry —nomological organization which picks out the network of physical distance relationships. Thus, as I see it, it is not an empirical theory, but a conceptual truth that physical space has, as its physical geometry, that geometrical structure which achieves, or comes as close to possible to achieving, the norm of nomological uniformity—that structure which gives, or comes as close as possible to giving, distance relations (and thereby all other geometrical properties) an unvarying nomological relevance over the domain of physical points. In short, it is a conceptual truth that physical geometry coincides with functional geometry. (Foster 1982: 143)

If Foster's principle about nomological uniformity is accepted, then, it would seem, the physical realist's appeal to simplicity must also be accepted, and the problem of the apparent conventionality of simultaneity ceases to be a challenge to physical realism.

[31] For a more technical exploration of a similar point, see the exchange between Ohanian (2004) and Macdonald (2005). Ohanian argues that the kinematic laws will be much more complex in deviant models, but Macdonald points out that this complexity in itself does not entail that no deviant model is true; it only entails that we naturally prefer the convention that laws are represented in a relatively simple way. See Salmon (1977: 273) for a similar point about the shape of conservation laws in deviant models.

I have two basic replies to this worry, corresponding to the two possible readings of Foster's principle that I can readily think of. On the first reading, the principle of nomological uniformity says that the same (non-disjuncive) laws hold throughout the world. Deviant scenarios concerning the one-way speed do not offend against that principle. Suppose that, in a simple 2D spacetime, light goes faster to the right than to the left. This law applies at all points in spacetime. So nomological uniformity, understood in this first sense, is not violated.

Alternatively, one can take Foster's principle to concern symmetry. The claim then would be that it is *a priori* that physical geometry is such that physical processes are invariant under rotations etc. On this reading, deviant scenarios violate the principle of nomological uniformity, because taking the mirror image of the 2D world just mentioned yields a physically different world. But this reading of Foster's principle is not only not *a priori* but it is empirically false, because there is at least one known interaction in nature, the so-called weak interaction, that does not obey chiral symmetry (Woit 2007: 77). So, depending on how we understand Foster's principle, the principle is either untenable or it does not disqualify deviant scenarios about the one-way speed of light.

An interlocutor might point out that Foster's principle does not rule out asymmetries in nature *a priori*; the point is to find those laws that are the simplest *given the empirical data*. And the interlocutor could argue that deviant laws about the speed of light cannot qualify as the simplest in this sense, since the deviances in question are undetectable and hence cannot figure in the data.

This seems to be an admissible (third) interpretation of Foster's principle, but this interpretation does not help the physical realist either, I believe. One can see why if one considers how this version of the principle fits into Foster's Gappy World argument (2.3.2). In the context of that argument, Foster acknowledges that there could be a real spacetime structure out there that does not match the empirically manifest structure. Hence Foster allows for the possibility of deviant scenarios; his point is (under the "empiricist" reading of his principle) is that the deviant structure in question is not *physical* space because physical space has laws that are maximally simple, given the empirical constraints. But this idea cannot be hijacked by the physical realist who wants to dismiss deviance by appeal to simplicity. For Foster justifies this "empiricist" reading of his principle in a way that leads to idealism about physical space: he argues that physical laws are maximally uniform because in cases when real and apparent space radically diverge, it is always the apparent space (with its maximally simple laws) that is the physical space, and we have no reason to assume that the situation is different when the divergence is less radical or even non-existent. Hence if the physical realist tries to defend her ideology by appeal to the "empiricist" reading of Foster's nomological principle, she also buys Foster's own justification of this principle, and hence buys into the claim that physical space is not real.

3.3.3 Mathematical arguments

Some philosophers and physicists have proposed mathematical proofs against deviant models. The most famous is by Malament (1977), who showed that the hypothesis of uniform one-way velocity is the only one that can satisfy certain symmetry principles. Briefly, and disregarding technical details, Malament proved the following: If we have an unaccelerated path *UP* in spacetime and we perform a reflection, rotation, or translation of the whole content of spacetime in such a way that *UP* is mapped onto itself, then the operation will only leave the rest of the spacetime intact if the one-way speed of light is uniform.[32]

The intuitive content of this proof can be illuminated by a simple example. Suppose that, in Case 1, a stone flies from spatial point *A* to spatial point *B* in *T* seconds. In Case 2, the same process unfolds in 2*T* seconds, with no change in the stone's trajectory except for the multiplication of the time coordinates by 2. Intuitively, if this transformation is applied to the whole content of spacetime (that is, to all point-events), then all other physical processes should look the same (apart from the time dilation). Generally, one can expect the content of space to remain invariant under transformations that map a specific physical process onto itself. Malament proves that this requirement entails that the speed of light is the same in all directions.

There are two problems with Malament's proof. As it was pointed out by Ben-Yami (2006: 466–71) and Sarkar and Stachel (1999), among others, the proof must allow for reflections that reverse the direction of time, in other words, Malament's admissible transformations include scenarios when history unfolds backward with respect to the original path *UP*. It is far from intuitive that such symmetries must obtain for actual systems, so Malament's proof can be criticized on the grounds that it is unsound.

Second, the requirement that spacetime be symmetrical in a way that happens to entail uniform one-way velocity appears to beg the question against the conventionalist (Grünbaum 2010, Janis 1983: 107–9). This stipulation carries no more weight in itself than Friedman-style appeals to simplicity.[33]

3.3.4 Eternalism

Some philosophers believe that the conventionality of simultaneity can be solved by adopting eternalism. Here's a brief statement of the idea:

> [T]he message, which the vicious circle [about the measurement of the one-way velocity] has been trying to convey to us is truly amazing—reality is not a three-dimensional world, because if it were, what exists would depend

[32] For summaries of the argument, see Jammer (2006: 257) and Ben-Yami (2006: 464–6).

[33] See Janis (2010: section 5) about other mathematical proofs. Feinberg (1967) argues against conventionality from tachyons (rejoinder: Pirani 1970), and Zangari (1994) uses considerations about spin-1/2 particles (rejoinder: Gunn and Vetharaniam 1995).

> on our choice and would also be a matter of convention. But what exists will not be a matter of convention if reality is a four-dimensional world with one temporal and three spatial dimensions. […] The vicious circle in determining the one-way velocity of light finds a natural explanation—light does not move at all since it is a forever-given worldline in spacetime. We arrived at the vicious circle because we asked an incorrect question about the real magnitude of the one-way velocity of light, whereas light does not propagate in spacetime (in the absolute reality according to Minkowski), and therefore does not possess such a property as velocity. (Petkov 2009: 159–60)[34]

This argument has the following shape:

(E1) If eternalism is true, then there is no movement (since the whole of spacetime exists eternally as a 'block').

(E2) If there is no movement, then there are no facts of the matter about the movement of light.

(E3) Therefore, if eternalism is true, then nothing corresponds in reality to the (purported) one-way velocity of light.

If this reasoning is sound, it constitutes its own *reductio*, because it entails an absurd consequence. If (E1)–(E3) is sound, then this argument is also sound:

(E1) If eternalism is true, then there is no movement (since the whole of spacetime exists eternally as a 'block').

(E2) If there is no movement, then there are no facts of the matter about the movement of light.

(E4) Therefore, if eternalism is true, there are no facts of the matter about the speed of light in general; specifically, there are no facts of the matter about the average round-trip speed of light.

But this conclusion is obviously absurd, since the average round-trip speed of light is a physical constant with a known value. Everyone in this debate agrees that the average round-trip speed is c (in vacuum, at any rate). If (E1)–(E3) proves that there are no facts of the matter about this, then the argument proves too much.

In response, a friend of the eternalist solution must argue that the concept of one-way speed is empty in eternalist universes, but the concept of *round-trip* speed is not. But it is hard to see any non-ad hoc way to establish this. Petkov's point is that there is no movement in an eternalist universe, hence light does not move at all in any specific direction. But if light does not move at all in any specific direction, then, *a fortiori*, it does not move in any specific direction *and back* either. So the eternalist cannot block (E4), and (E4) constitutes a *reductio* of the eternalist argument.

[34] For earlier versions of this argument, see Wingard (1972) and Petkov (1989). Note that this argument is different from Putnam's (1967) contention that presentism is false because of the *relativity* of simultaneity, i.e. because two observers can disagree on temporal precedence.

3.3.5 Gauge freedom

Some philosophers think that the conventionality of simultaneity is due to the fact that the one-way velocity of light is not a real feature of the physical world even though the physical world itself is real. Adolf Grünbaum is one of the champions of this view:

> [It is a mistake to think that] Einstein's repudiation of Newton's absolute simultaneity rests on a mere *epistemic* limitation on the ascertainability of the existence of relations of absolute simultaneity. To be sure, human operations of measurement are indispensable for *discovering* or *knowing* the physical relations and thereby the time relations sustained by particular events. But these relations are or are not sustained by physical macro-events quite apart from *our* actual or hypothetical measuring operations […]. [It] is because no relations of absolute simultaneity *exist* to be measured that measurement cannot disclose them. (Grünbaum 1963: 368)

Grünbaum's point is that there is nothing in reality corresponding to the hypothetical relation of distant simultaneity: in reality, there are no facts of the matter about which moment in my history is simultaneous with the light beam hitting a distant mirror or detector.[35] As we saw, the problem of distant simultaneity is equivalent to the problem of the one-way velocity of light. So Grünbaum's solution boils down to the claim that there are no facts of the matter in physical reality about the one-way velocity of light.

The gist of this solution is that the way we represent the one-way velocity of light is a matter of choosing a certain set of coordinates instead of another, akin to the choice between measuring a certain length in feet or meters.[36] More technically, one can say that our representations of light are subject to a certain *gauge freedom*—just as physical reality doesn't care whether we count distances in feet or meters, it doesn't care whether we represent light as having a uniform or a non-uniform one-way speed.

Gauge freedom is a prevalent phenomenon in spacetime physics. As Tim Maudlin explains:

> [T]he geometrical structure of a spacetime diagram is not the same as the geometrical structure of the space-time being represented. What we are doing when we draw a diagram is using one kind of geometrical object to represent another. Since the geometries of the two objects are not the same, we must pay close attention to which aspects of the

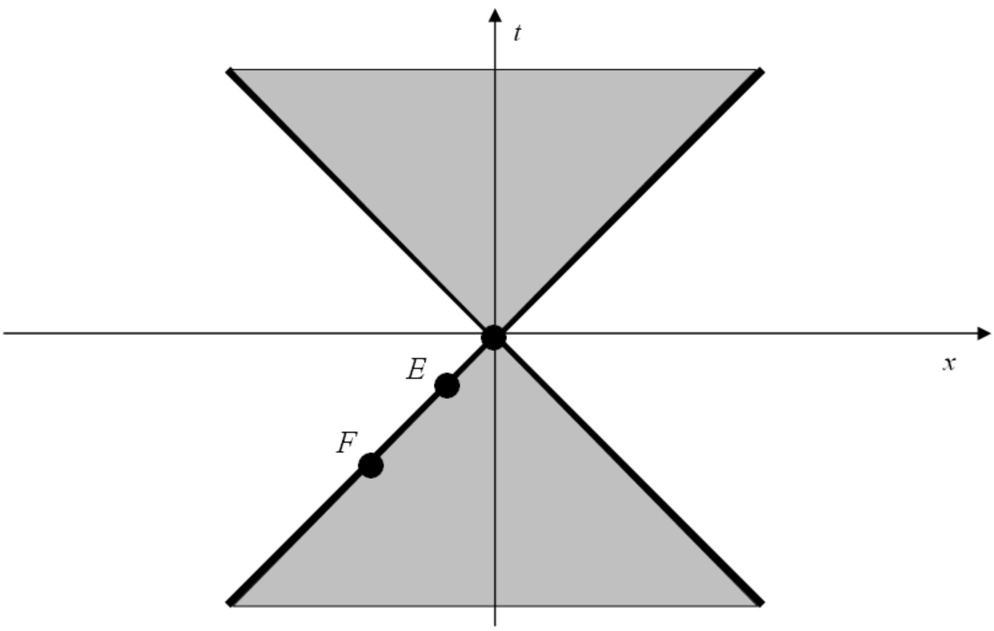
[35] It is interesting to note that Reichenbach, the other great 20th century champion of the conventionality of simultaneity, believed the exact opposite: he thought there might be facts about the one-way velocity, but they are unknowable (Jammer 2006: 200, Friedman 1977: 426).

[36] Apart from Grünbaum, Mittelstaedt (1977) and Weingard (1985) also espouse this view.

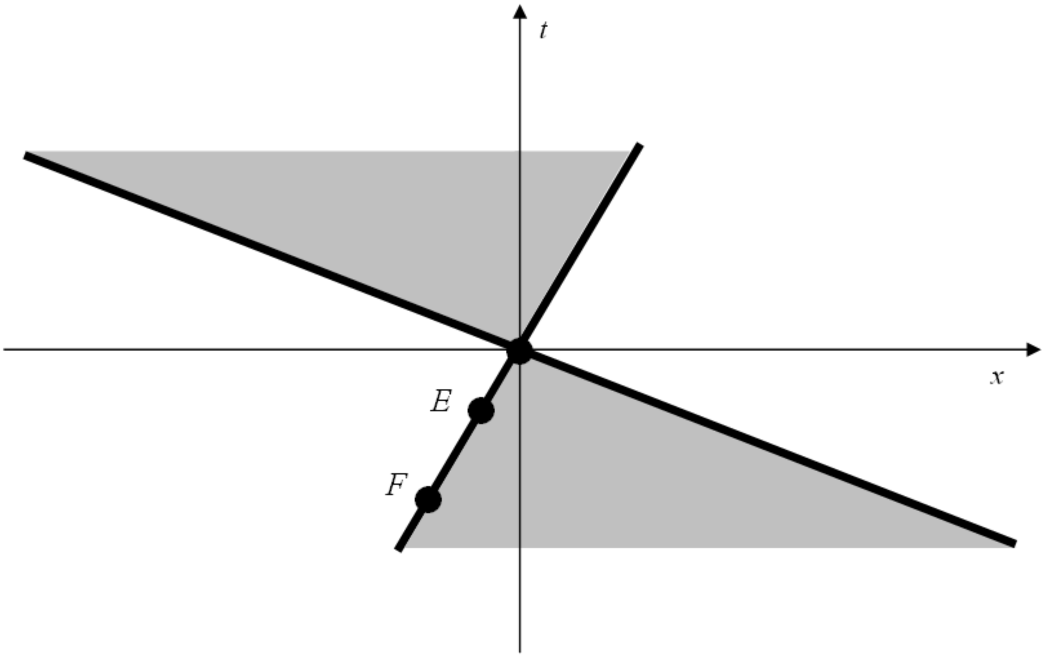
> diagram correspond to real physical facts and which are merely conventions. In the case of Newton's own account of space and time, […] the *angle* of a trajectory on the diagram has a physical significance: it represents the *absolute velocity* of a body, with objects at absolute rest occupying vertical trajectories. But in Galilean space-time [= a spacetime where Newtonian laws hold but there is no privileged frame of reference], there are no absolute velocities. It is a matter of arbitrary choice which straight trajectories are depicted as vertical and which as "tilted" in the diagram. (Maudlin 2012: 63)

Just as there are no absolute velocities in Galilean spacetimes, likewise, there is no fact of the matter about the one-way speed of light. Just as we are free to shift the contents of a Galilean spacetime diagram 1 meter to the right, without any change to the real content of the resulting representation, likewise, we are free to assume either uniform or non-uniform one-way speed in special relativity, without any change in the real content of the resulting representation. Or so the friend of Grünbaum's solution claims.

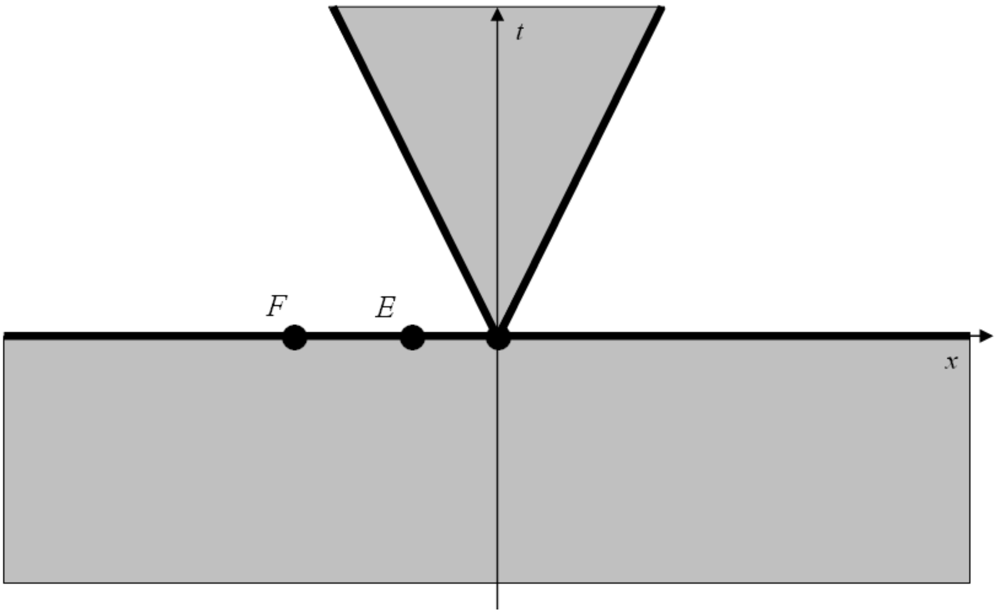
One way to clarify Grünbaum's solution is to say that physical reality only contains causal relations, and these relations can be metrized in different ways, corresponding to different (conventional) assumptions about the one-way velocity of light. Suppose, for example, that we have two point-events, *E* and *F*, such that *F* is causally connected to *E* via a light signal and *E* is causally connected to the origin via a light signal. Assuming that the one-way velocity of light is uniform, one will represent the relative spatiotemporal positions of the three events the following way:



If one adopts a deviant model where light goes more slowly to the right than to the left, then one will adopt the following alternative representation of the relative positions of *E*, *F*, and the origin:



If one adopts Ben-Yami's deviant model (see p.79), then the relative position of the three events will be represented like this:



And so on. Every specific deviant model will give rise to its unique way to represent the relative positions of *E*, *F*, and the origin. The differences between these ways to represent the events in question will depend on differences between the shape of light cones in different models.

Grünbaum's point can now be reformulated in the following way: There are no facts of the matter about the 'real' shape of the light cone; the real facts are confined to the relations of causal precedence between various events. In our example, physical reality contains facts about the causal precedence of *F* over *E* and about the causal precedence of *E* over the origin. But when we start representing these three events in a coordinate system, the rest of the story is up to gauge freedom. We are free to assign numbers to these three events in any way we like (within certain limits), just as we are free to represent the length of the meter stick as 1 or (counting in feet) as 1 / 0.3048. Reality does not force us to count in meters as opposed to feet. Similarly, reality does not force us to assign one specific one-way velocity to light instead of another (as long as the round-trip velocity constraints are respected).

The trouble with Grünbaum's solution is that it seems hard to accept that there are no metrical facts about the physical world, only relations of causal precedence. As Michael Friedman remarks:

> Grünbaum has given us no reason to accept the view that the only objective temporal relations are constituted by causal relations. Indeed, how could one possibly support such a view? Our only grip on which properties and relations are objective constituents of the physical world is via our best theories of the physical world. The properties and relations that we hold to exist objectively are those that our best physical theories postulate. And since out best theories do not merely postulate the kind of *ordinal* (causal) temporal relations favored by Grünbaum—they postulate metrical relations as well—we have no reason to grant such ordinal (causal) relations the privileged ontological status that Grünbaum wants to ascribe to them. (Friedman 1977: 430)

Notice that Friedman's point does not presuppose absolutism about physical quantities. There can be facts of the matter about the one-way velocity even if physical quantities must be understood in a relationalist way, since there will be an (uneven) relation between the speed of light in one direction and its speed in another direction. So one cannot dismiss Friedman's point by denying that physical quantities are absolute.

The basic problem about Grünbaum's solution is similar to the problem about the eternalist solution. The gist of the eternalist solution is that there is no movement in an eternalist cosmos, hence there are no facts of the matter about the one-way speed of light. This suggestion is shipwrecked by the fact that the average round-trip speed of light is a physical constant with a known value. If the eternalist solution were sound, then there would be no facts of the matter about the round-trip speed either. Similarly, if Grünbaum is right in claiming that the one-way speed of light is subject to considerable gauge freedom, then, intuitively, the average round-trip speed of light should be subject to the same kind of gauge freedom. But it isn't. Granted, the average round-trip speed of light is subject to some gauge freedom in the sense that one is free to express it in meters per second, feet per lunar month, or any other speed unit one likes. But this is not the same kind of gauge freedom that affects the *one-way* speed of light, which can be freely chosen within certain limits even after we fix a speed unit. Since there seem to be metrical facts about the physical world (e.g. the round-trip speed of light), the claim that the only real physical facts are facts about causal precedence seems to be false. Hence, it is far from clear that Grünbaum's solution really works.

3.3.6 Summary of 3.3

The previous five sections surveyed those responses to the conventionality of simultaneity that can be adopted by physical realists. In 3.3.1, I discussed attempts to measure the one-way velocity of speed. If any of these attempts had some chance of succeeding, the puzzle would find an empirical resolution. I presented a seemingly straightforward way to measure the one-way velocity, then I pointed out that it contradicts one of the basic assumptions of relativity. I also indicated that we have no reason to think that any other proposed method works.

Section 3.3.2 looked at arguments that appeal to symmetry. The gist of these arguments, championed by Michael Friedman among others, is that positing non-uniform one-way speed introduces an asymmetry into spacetime without explaining anything, hence deviant models can be disregarded. I argued that Friedmann's point concerns pragmatics rather than ontology: if physicists suddenly found it more convenient to use deviant models for their calculations, the real one-way speed would not change as a result. But even if we disregard this point, appeals to symmetry can only provide an epistemic, as opposed to metaphysical, solution to the dilemma, since these appeals presuppose that the one-way speed could have been different. Arguably, it would much be better to solve the puzzle by showing that deviant models are impossible or by showing that they do not represent a real difference from the standard case.

Section 3.3.3 briefly discussed David Malament's celebrated proof that only the hypothesis of uniform one-way speed satisfies certain symmetry constraints. Drawing on the work of Ben-Yami, Grünbaum, and others, I claimed that (i) Malament's proof presupposes that worlds where our history unfolds backward are relevant in terms of actual symmetries, which is a questionable premise, and (ii) the assumption that spacetime must conform to the symmetries that Malament favours begs the question against the conventionalist. Hence, Malament's proof is not substantially different from Friedman-style appeals to simplicity.

Section 3.3.4 addressed the idea that the puzzle of the conventionality of simultaneity is dispelled by eternalism. The gist of the eternalist solution was that there is no movement in an eternalist cosmos, hence there are no facts of the matter about the one-way speed of light. I claimed that if this argument is sound, it entails its own *reductio*, because it establishes that there are no facts of the matter about the average round-trip velocity of light, which is a physical constant with a known value.

Finally, 3.3.5 addressed Grünbaum's contention that the one-way velocity of light is subject to gauge freedom. According to Grünbaum, physical reality involves relations of causal precedence only, and those relations are left intact when we move from deviant to non-deviant models or from one deviant model to another. Drawing on a suggestion by Michael Friedman, I argued that Grünbaum's theory is implausible because it entails that there are no metrical facts about physical reality whatsoever. Specifically, I pointed out that this idea contradicts the uncontroversial fact that the average round-trip speed of light is a physical constant with a known value.

To sum up, it seems reasonable to conclude that the puzzle about the conventionality of simultaneity has no straightforward and uncontroversial physical realist solution. Even if there is a sound solution somewhere, its details are far from evident and it doesn't seem to be much publicized.

3.4 The idealist solution

3.4.1 Sketch of the solution

The idealist solution to the puzzle of the conventionality of simultaneity is quite simple. We saw in Chapter 1 that the definition of ideal physical properties is roughly the following:

Ideal physical properties:

(IP) Physical property P is ideal $\approx_{df}$
$\Box\ \forall x$: x is $P \supset$ Someone observes or could observe that x is P.

(The parts of the definition that are missing, namely time indices, the condition that observations are preceded by exploratory actions, and the parts that are needed to defuse the counterexamples from 1.3, are not relevant here.)

To find out how idealism handles the puzzle of conventionality, let's apply (IP) to velocity:

Ideal velocities:

(IV) Velocity is an ideal property $=_{df}$
$\Box$ Some x has velocity $V \supset$ Someone observes or could observe that x has velocity V.

As indicated in 1.2, it is natural to assume that all physical properties are ideal if idealism is true. It follows that

(i) If idealism is true, then light does not have a real velocity (because all physical properties are ideal).

(ii) By (IV) and (i), if idealism is true, there are no unobservable velocities.

Since the one-way velocity of light is unobservable, it follows from (ii) that light does not have a one-way velocity under idealism. In idealist worlds that have the kind of laws we do, there is no fact of the matter about the one-way velocity of light. Hence, if idealism is true, we don't have to ascertain that light moves with the same one-way speed in all directions, because there are no facts of the matter about those speeds. The puzzle about the conventionality of simultaneity is smoothly dissolved by idealism.

3.4.2 Elaborating the solution

It is worth investigating the idealist solution in a bit more detail, because even if the solution is formally straightforward, one might complain that it does not render the puzzle any less puzzling. How come that light has no speed going from here to the mirror?

To get a feel for the idealist answer, let's investigate a toy idealist world containing two immaterial subjects, Alice and George. We also assume that the laws of relativity (or their idealist equivalents, at any rate) hold in this world.

Facts about the world of Alice and George are facts about sensory episodes that are structurally and temporally harmonized. One can build an intuitive picture of this by invoking the concept of points of view. We all have an intuitive notion of what it means to have a point of view. It means, typically, that you have the visual experience of a spatially extended environment, perhaps of a quad like this:

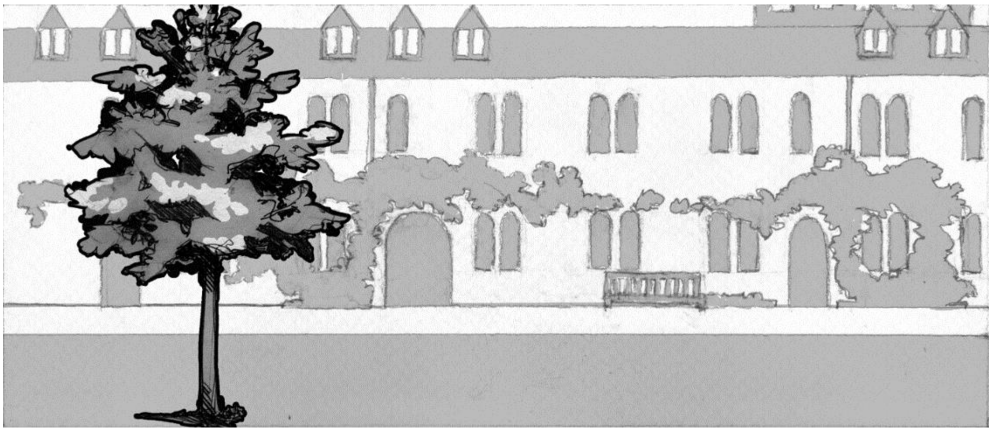


Fig. 1 *A visual field*

The visual field can undergo various changes. The shapes that populate it at one moment give way to different shapes at later moments, giving rise to the experience of movement and change. Let's call the sum total of changes in the visual field of some subject *S* "the visual stream of *S*." (To be precise, one should also consider other sensory media like hearing and smell, plus proprioception and other forms of inner sense. I'll ignore these important aspects of experience, because they are not directly relevant to the puzzle at hand.)

Consider a toy idealist world containing two visual streams. The owners of the streams experience standing in a quad like the one in Fig.1, facing each other. The owner of the first stream is Alice. This is what Alice sees right now:

Fig. 2 *Alice's visual field at t_0*
(on Alice's time)

The owner of the second stream is George. This is what George sees now:

Fig. 3 *George's visual field at t_0*
(on George's time)

Alice and George can initiate changes in their visual streams. For example, George can perform an action he calls "raising my left hand." This action results in the following change in his visual field:

Fig. 4 *George's visual field at t_1 (on George's time)*

When George raises his left hand, Alice's visual field changes into this:

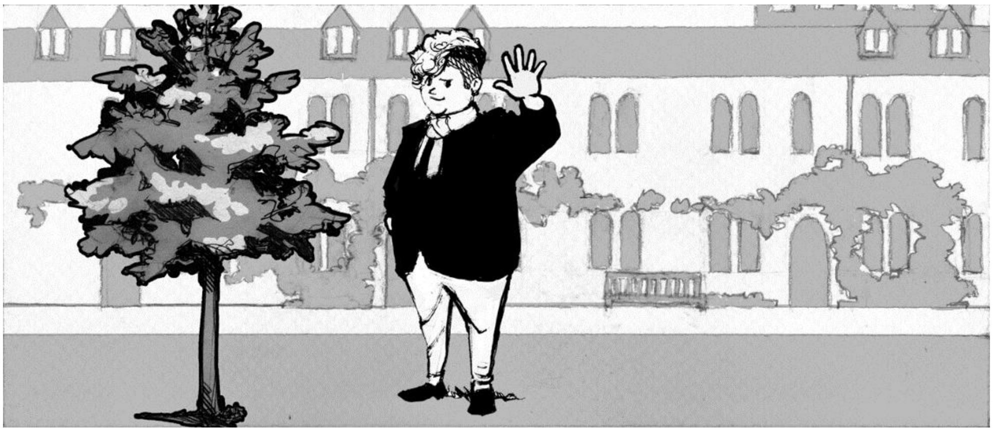


Fig. 5 *Alice's visual field at t_1 (on Alice's time)*

Such rules about the relationship between action and experience make it possible for Alice and George to interact. Alice and George live in the same world in virtue of the fact that their sensory streams are harmonized.

The visual streams of Alice and George are harmonized (i) *structurally*, so that if George raises his hand (from his perspective), Alice sees a hand raised (from her perspective), and (ii) *temporally*, so that if Alice sees George raise his hand, and raises her own, this fact registers in George's visual steam later than his own hand-raising. We may assume that these rules cover a large range of possible interactions (e.g. walking around the quad, handing each other objects, communicating etc.).

Suppose that Alice and George start testing various consequences of special relativity. They are faced with a choice between the standard theory where the one-way speed of light is uniform in all directions (let's call this theory "*U*") and various deviant models where the one-way speed of light is direction-dependent (let's call a representative deviant model "*NU*"). Now consider two scenarios.

In the first scenario, Alice and George synchronize two clocks (remotely or locally). They proceed to test some predictions of special relativity derived from *U*. Their measurements confirm all predictions.

In the second scenario, Alice and George synchronize their clocks and test special relativity using *NU*. Their calculations take a bit more time but their predictions are again confirmed.

If Alice and George were living in a real spacetime, there would be four relevant possibilities concerning the choice between *U* and *NU*:

<u>*Realist Case 1*</u>

Alice and George use the *U*-theory AND
The one-way velocity of light is uniform AND
The predictions of *U* are corroborated.

Realist Case 2

Alice and George use the *U*-theory AND
The one-way velocity of light is not uniform AND
The predictions of *U* are corroborated.

Realist Case 3

Alice and George use the *NU*-theory AND
The one-way velocity of light is not uniform AND
The predictions of *NU* are corroborated.

Realist Case 4

Alice and George use the *NU*-theory AND
The one-way velocity of light is uniform AND
The predictions of *NU* are corroborated.

In two of these cases (2 and 4), Alice and George get the structure of the physical world wrong, even though their predictions check out and they have no way to tell that they got something wrong.

However, given that Alice and George live in an idealist spacetime, there are only *two* relevant possibilities:

Idealist Case 1

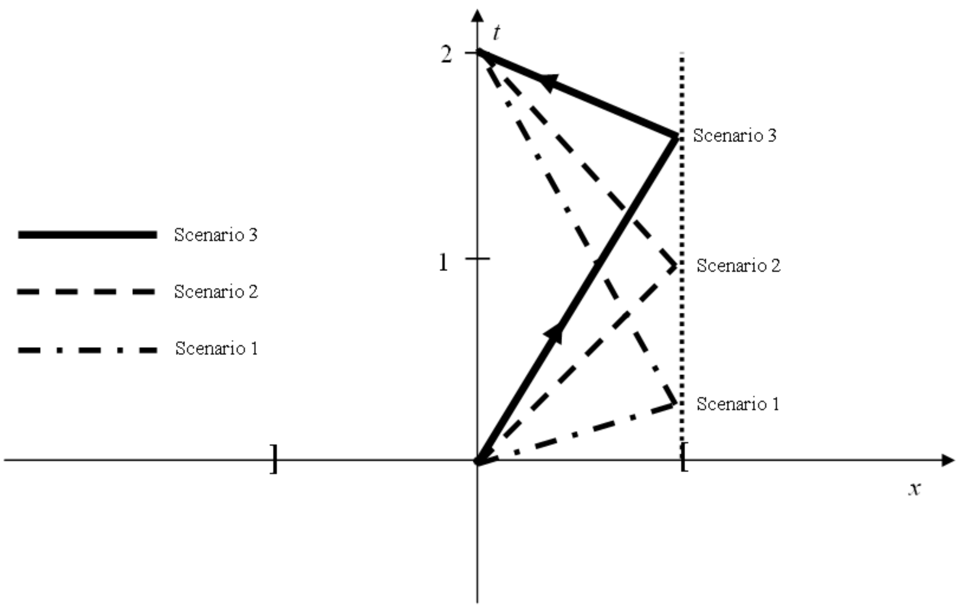
Alice and George use the *U*-hypothesis AND
The predictions of *U* are corroborated.

Idealist Case 2

Alice and George use the *NU*-hypothesis AND
The predictions of *NU* are corroborated.

In idealist worlds, Alice and George cannot get the structure of the physical world wrong by choosing *U* instead of *NU* (or vice versa). The choice between those two models will concern pragmatic and aesthetic issues only. Presumably, *U* is easier to work with or it is more pleasing to the intellect.

To see how this state of affairs is underwritten by the ontology of idealist worlds, let's consider three hypotheses about the one-way speed of light:



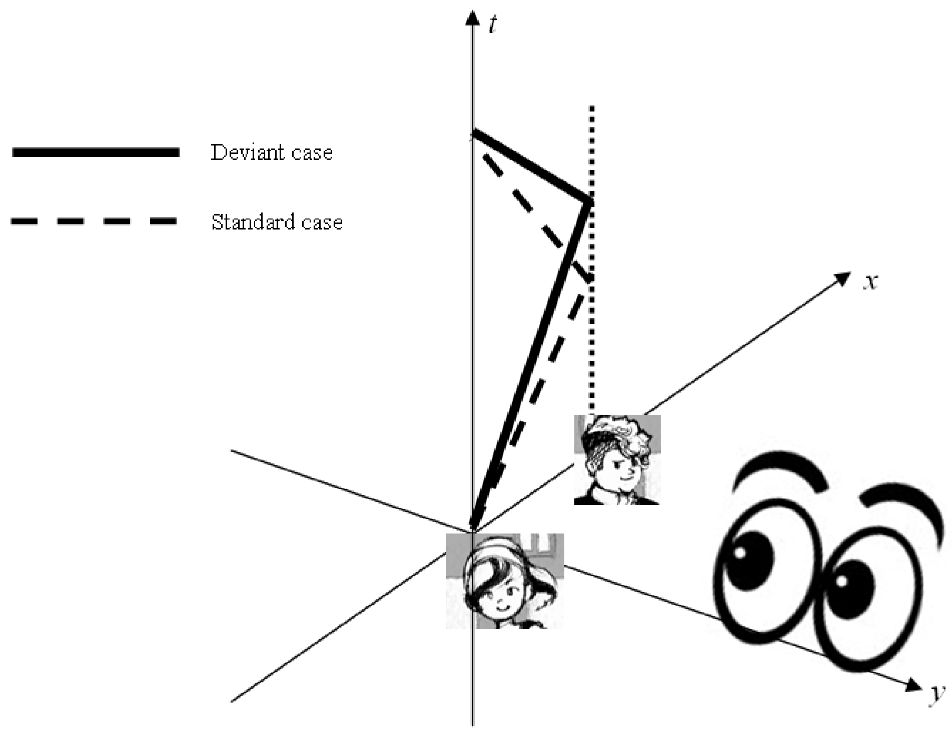
In Scenario 1, light goes faster than *c* to the right and slower than *c* to the left. In Scenario 3, it's the other way around. Scenario 2 represents the standard case when the one-way velocities are uniform. If the spacetime of Alice and George were real, at least two of these trajectories would represent false hypotheses about what happens in real space between Alice and George. However, given that the spacetime of Alice and George is ideal, nothing in their world corresponds to the lines in the diagram. Real concrete facts about the measurement process are exhausted by the fact that Alice has the experience of sending a light beam at a certain moment, then sees it return, and George has the experience of reflecting a beam back at Alice. The lines in the spacetime diagram do not and cannot register in the visual streams of Alice and George, or of anyone else. The only role of these lines is to help Alice and George anticipate measurement results. They do not correspond to anything in (idealist) reality.

3.4.3 Two objections

I can anticipate two objections to this solution. The first is this:

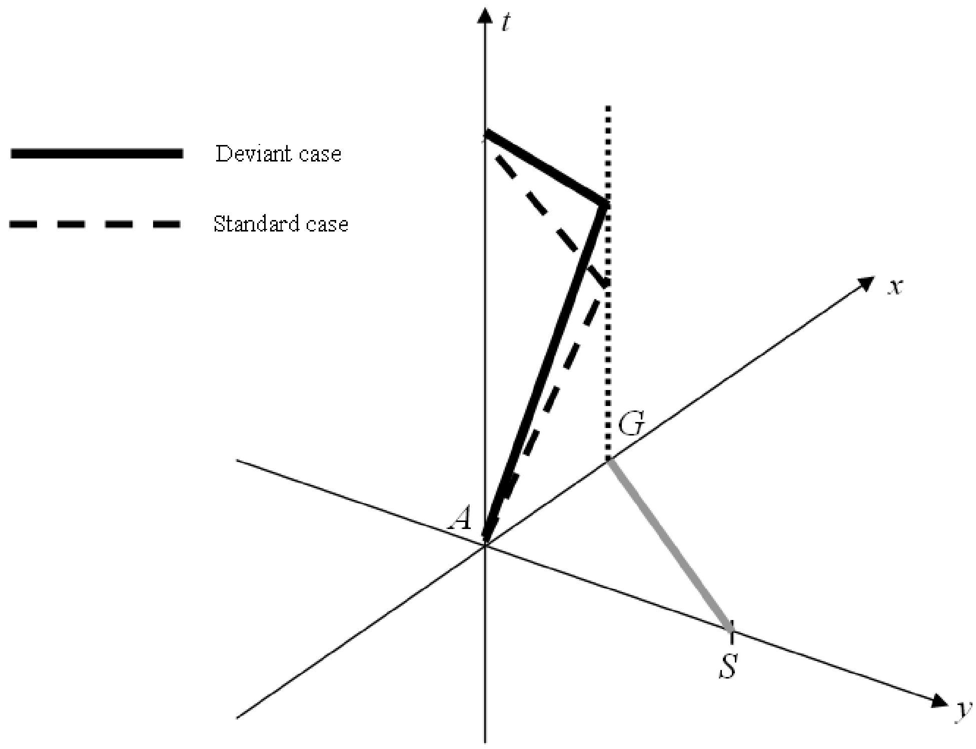
> You claim that there are no facts of the matter about the one-way velocity of light in idealist worlds because nothing corresponds to the lines that represent light beams. But suppose that, apart from Alice and George, there is a third subject *S* in the toy world, and *S* is looking at Alice and George from the side. *S* will see a light beam pass from Alice to George and back. There will then be phenomenal facts that correspond to one of the lines in the diagram.

The interlocutor is describing the following situation. A spectator, *S*, is situated in such a way that the light beam traveling from Alice to George travels horizontally in *S*'s visual field:



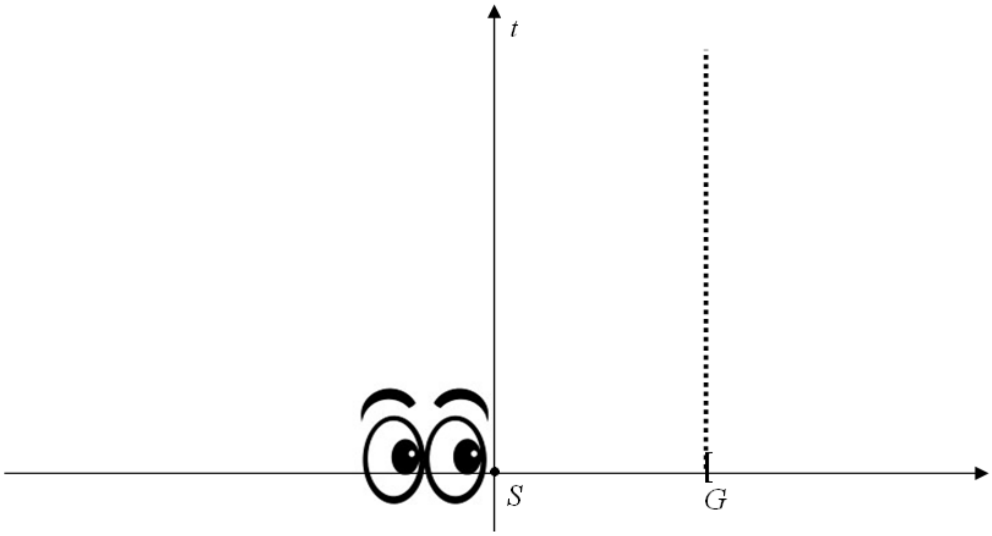
The interlocutor claims that, given this setup, there will be phenomenal facts that play the same theoretical role as the one-way trajectory of a real light beam. Hence, the idealist cannot solve the conventionality issue by saying that nothing real corresponds to the lines in the spacetime diagram.

To asses this objection, let's see how the event of the light beam's reaching George registers for *S*. Suppose that *S* is looking at George, anticipating the moment when the light beam reaches George:



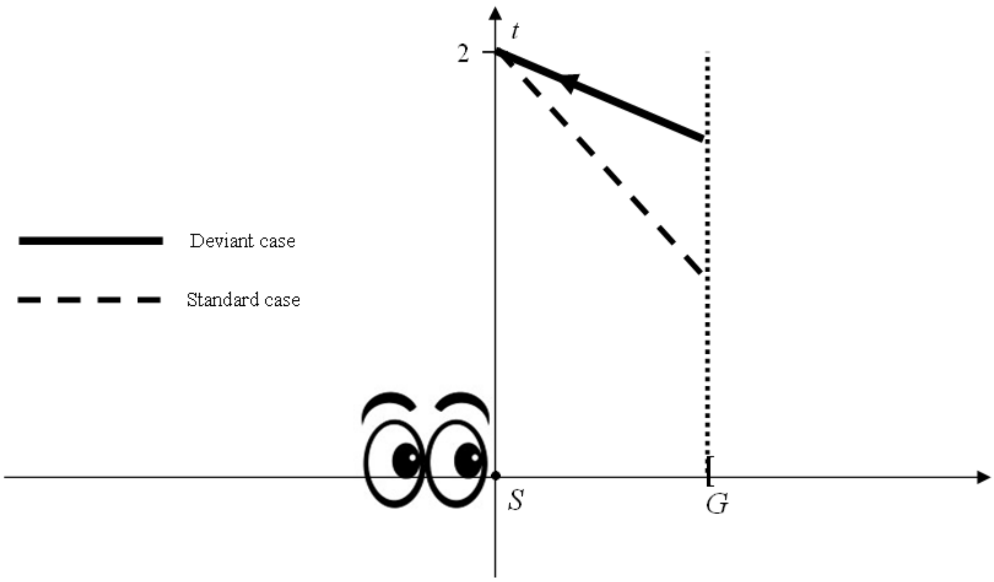
The objector claims that there will be phenomenal facts of the matter about which of the two scenarios on the diagram obtain (if any), hence there will be facts of the matter about the one-way velocity even in idealist worlds.

To see why this worry mistaken, let's take a cross-section of spacetime along the line *SG*:



The goal of S is to find out which point on the dotted line is the event of the light beam's reaching George.

In order for S to see that the light beam has reached George, light must travel from G to S. And in order for S to know the exact moment at which the light signal reached George, S must know how long it took light to travel from G to S. And that duration, in turn, will depend on the one-way velocity of light from G to S. For example, the fact that S registers at $t = 2$ (on S's time) that the light beam reached George will be compatible with both standard and deviant assumptions about the one-way velocity, leading to competing hypotheses about the moment of reflection:



It follows that facts about the visual stream of a third spectator cannot go proxy for facts about the trajectory of a real light beam. The phenomenal facts of a third spectator will be subject to the same kind of underdetermination as the experience of Alice and George.

A second, less formal, objection to the idealist solution is that it does not dispel the mystery of conventionality but locates it at a different level. For even if there is no real light beam in idealist worlds, and hence nothing corresponds to the lines between Alice and George in the spacetime diagram, there will be a real mental event corresponding to the arrival of the light beam to George. The moment when George sees a flash of light coming from Alice will come at some point between the moment when Alice sends the light beam and the moment when the beam comes back to her. If the one-way speed of light is a matter of convention, it will also be a matter of convention when, on Alice's timeline, that event occurs. And it is no less mysterious how such a relation can be purely conventional. More to the point, the same kind of underdetermination that we find in the realist case is reproduced in idealism at the level of distant mental events.

In response, the idealist can say two things. The first is that as long as Alice and George are less than 100 miles apart, competing admissible scenarios about the one-way speed will disagree about the moment of the light beam's arrival by less than 0.0005 seconds. Such minuscule periods cannot be consciously apprehended, therefore facts about the distant simultaneity of mental events are not underdetermined in idealism as long as subjects are not far removed from each other.

Granted, the underdetermination can be cranked up to a level that is on the scale of conscious apprehension if subjects are very far from each other. Suppose, for example, than Alice is on Venus, George is on Earth, and they communicate via radio. The round-trip time of the radio signal is 5 minutes. The idealist must say that there is no fact of the matter about when, on Alice's timeline, George receives the signal during the 5 minutes that pass while she is waiting for an answer. But the idealist can bite the bullet here and say that a common 'now' requires spatial proximity. Subjects at cosmic distances are not part of the kind of shared time order that we know from ordinary experience.

3.4.4 The superiority of the idealist solution

It is clear that idealism solves the puzzle of the conventionality of simultaneity in a very straightforward way. Moreover, the solution is also uncontroversial in the sense that idealism is assumed to be true, the explanation about the source and nature of the underdetermination that affects the one-way speed of light is not up to dispute. In this sense, the idealist solution is superior to physical realist ones. Possible physical realist solutions are far from uncontroversial in the same sense, because physical realists fiercely disagree on all of them.

Since the idealist has a straightforward and uncontroversial solution to the conventionality of distant simultaneity, idealism explains at least one important feature of spacetime better than physical realism. Hence, inference to the best explanation can motivate the view that spacetime is not real.[37]

Ideally, the discussion should be carried further into an examination of general relativity. I have neither the space nor the expertise to do so. However, it seems to me that idealism might be able to solve the debate between field and geometrical interpretations of general relativity (see e.g. Ben-Menahem 2006: Ch.3 for an overview of the problem). Idealism might be able solve this puzzle in a way remotely analogous to the example in 3.1, that is by denying, on phenomenological grounds, that there is a real difference between curved space and forces acting in space. Of course, this is merely speculation at this point, and the attendant problems are extremely complex.

[37] One can interpret the puzzle in an antirealist manner as well, denying that our models are meant to fit something called "reality." As indicated in the Introduction, this dissertation is concerned with the dispute between idealism and physical realism only.

Finally, let me note that the idealist solution to the conventionalist puzzle follows the schema that was introduced in 3.1. The one-dimensional world of Albert the ant illustrated that idealism transforms underdetermination problems into problems about the most convenient way to predict future experience, while realism, when faced with the same problems, postulates excess structure that makes the physical world partly inscrutable. In 3.2–3.4, the same contrast emerged in the context of a puzzle about actual physics. We saw that if idealism is true, then the way we represent the one-way velocity of light is a pragmatic-aesthetic issue about the best tool for anticipating future experience. Physical realism, on the other hand, when faced with the same problem, introduces an inscrutable extra feature into reality.

All in all, this chapter corroborates Foster's abductive thesis that real spacetime is an explanatorily idle posit that should be thrown away in the interpretation of physics.[38]

[38] It is interesting to note that Einstein seems to have been aware of the idealist solution. F.S.C. Northrop (1941) recalls that, in conversation with Einstein, he interpreted Whitehead as claiming that reality ultimately consists of mental events and relativity theory is to be understood in terms of facts about experience. "Oh! Is that what he means?," Einstein is reported to have replied. "That would be wonderful! So many problems would be solved were it true! Unfortunately, it is a fairy tale. Our world is not as simple as that." And after a moment's silent reflection he added: "On that theory there would be no meaning to two observers speaking about the same event" (Northrop 1941: 204, quoted by Jammer 2006: 162). This anecdote contains the seeds of a further possible objection to the idealist solution, namely the objection that idealism cannot account for the publicity of the physical world. Addressing this complaint would require a separate essay on singular terms and intersubjectivity that I cannot hope to include here. For suggestions, see the *Third Dialogue* (II: 247–8) on the identity of physical objects in idealism, and Foster (1982: Part V) on intersubjective time.

4 Truthmakers and laws in idealism

The goal of this chapter is to face two important worries that are not related to the structure of physical objects but that challenge the metaphysical tenability of idealism in a more general way. The *truthmaker objection* says that the idealist cannot supply truthmakers for physical truths. The *nomic objection* alleges that the idealist cannot explain natural laws.

Section 4.1 addresses the truthmaker objection. The gist of this worry is that the idealist cannot explain what makes truths about unobserved physical objects (or, more generally, truths about persisting physical objects) true. I'll examine this worry in two steps. Section 4.1.1 looks at truths about prehistory. This area seems especially fertile ground for developing the truthmaker worry, since the claim that physical objects are not real seems to entail that most of the alleged history of the cosmos did not really happen. I'll argue that this worry can be addressed in two ways, either by adopting a sparse Humean version of idealism or by positing God (or, more precisely, God's conception of the physical worlds as a seemingly autonomous system) as the truthmaker for prehistory. Section 4.1.2 looks at the case of contemporary unobserved objects, reaching a similar conclusion.

Section 4.2 addresses the nomic objection, according to which the existence of natural laws is a mystery for idealists. I'll address this worry in three steps, by looking at three markedly different, influential accounts of laws, and examining whether the idealist can adapt them to her own ontology. Section 4.2.1 deals with contemporary Humeanism about laws, section 4.2.2 looks at the theory of laws as second-order universals, and section 4.2.3 focuses on laws derived from intrinsic powers. I'll argue that the idealist can adapt each of these theories to her own ontology, the only serious requirement being that idealism must be conjoined with theism if a nonHumean theory is adopted.

The upshot of the discussion will be that idealism can easily ground the structure of the physical world in real facts if idealism is conjoined with a sparse Humean metaphysics or with theism. My own preference is for the latter, but the official message of this chapter that there are at least two coherent version of idealism that are immune to the truthmaker objection and the nomic objection.

4.1 Truthmakers

Intuitively, it is not clear how the idealist can explain truths about the physical world. If real physical things do not account for the presence of persisting objects of perception, then what does? David Armstrong (2004: 1n1) recalls that truthmaker theory was developed partly to make this worry more explicit. Although the worry can be spelled out in other ways as well, I'll use the idiom of truthmaking, because it is very convenient for present purposes. More specifically, I'll adopt the following principle:

Truths Need Truthmakers:

(T) If *P* is a true proposition about the actual world, then there are some actual entities, the *x*s, such that the *x*s make *P* true in the sense that the existence of the *x*s entails that *P* is true.

For example, Fido the dog is a truthmaker for the proposition that dogs exist. Nuclear missiles are truthmakers for the proposition that nuclear disarmament has not happened. And so on.

Suppose that there is a table in room 412 and there are no observers in 412 at the moment. Conditions are normal, so the following proposition is true:

(P) If someone enters room 412, they will see a table.

The truthmaker objection can then be formulated as the following argument:

(1) (P) is a true proposition about the actual world.

(2) Therefore, by (T) and (1), some *x*s make it true that those who enter room 412 will see a table.

(3) If idealism is true, then the only candidate truthmakers for (P) are immaterial minds and their mental states.

(4) Immaterial minds and their mental states cannot make it true that those who enter 412 will see a table.

(5) Therefore, by (2)–(4), (P) cannot be true if idealism is true.

The idealist obviously needs truths like (P) to build a sane physical ontology, so idealism is in trouble if (1)–(5) is sound.

The argument has three premises, (1), (3), and (4). Premise (1) is true by hypothesis. Premise (3) sounds plausible, since there are no real concrete entities apart from minds in idealist worlds. So the soundness of the argument depends on (4), which says that immaterial minds cannot make claims about unobserved physical objects true.

In the following, I examine the possible idealist responses to this problem in two stages. Section 4.1.1 deals with truths about prehistory (where the problem is especially acute), and 4.1.2 looks at truths concerning the present.

4.1.1 Truthmakers for prehistory

Intuitively, the prehistoric past is a domain where the truthmaker problem is particularly vexing for the idealist. If physical objects are not real, then it is hard to see how there could have been physical facts prior to human history.

The doctrine that the there were no physical facts prior to human history was famously expounded, independently of idealism, by a Christian fundamentalist, P. H. Gosse, in *Omphalos* (1857). The title (which means “navel” in Greek) hints at Gosse’s claim that the biblical Adam had a navel not because he had a real mother but because God wanted to make Adam’s body conform to His conception of the natural order. More generally, we can take Omphalism to be the thesis that history is roughly as long as human history and the world contains apparent traces of an unreal past.

Idealism is often charged with Omphalist leanings (see BonJour 2011: 2.1, Price 1950: 298, Sellars 1963: 84). The thought behind the charge is roughly the following: If the physical world is a construction from experience, then no physical events predated experience. So most of our alleged prehistory (the Big Bang, the formation of the planets, the continental drift, the Jurassic period etc.) did not happen. More technically, the claim is that the idealist cannot supply truthmakers for prehistory. This sounds quite problematic.

To assess the objection from Omphalism, which is a variant of the general truthmaker objection, let’s invoke the (simplified) standard definition of idealism:

<u>Ideality</u> (standard version):

(IS) O is ideal $\approx_{df}$
$\Box$ O exists $\supset$ O is observed or observable by someone

Now suppose that the idealist wants to ground the following (hypothetical) truth about prehistory:

(6) At the place where the Big Ben stands today, a Brontosaur grazed 150 million years ago.

Suppose, further, that dinosaurs were unminded physical objects. (If this idea is contested on the grounds that dinosaurs had minds, the argument can be restated in terms of prehistoric volcanic eruptions or other brute physical events.) Let t_{-150M} be a moment 150 million years ago and let p_{BB} be the place where the Big Ben stands today. Then (6) and (IS) entail that

(7) At p_{BB} at t_{-150M}, a Brontosaurus was observed or observable by someone.

Ex hypothesi, there were no subjects 150 million years ago, so (7) reduces to

(8) At p_{BB} at t_{-150M}, a Brontosaurus was observable by someone.

If the idealist can supply truthmakers for (8), the charge of Omphalism is deflected. And if the idealist cannot supply truthmakers for (8), then the charge of Omphalism is formally established.

To find truthmakers for (8), the idealist must find truthmakers for counterfactuals about potential prehistoric experience. But it is hard to see how something like (8) can be true on idealism. If there are no subjects around, then nothing is observable by subjects, one would think. Worse, it seems clear that in idealism, nothing exists if subjects don't exist. It follows that nothing existed 150 million years ago if idealism is true, and therefore nothing could have made (8) true if idealism is true.[39]

In reply, the idealist might tell the following story:

Backward Projection:

> (8) is true because the laws of nature, when projected backward through a 150-million-year-period from the start of human history, yield the conclusion that, if someone had been around at p_{BB} at $t_{-150\mathrm{M}}$, they would have observed a Brontosaurus.

Backward Projection is a coherentist theory of prehistoric truth. Its upshot is that the hypothesis that (8) is true coheres well with human history plus laws.[40]

Backward Projection passes the buck to the idealist account of natural laws. This issue will be explored in 4.2 below, and I'll argue there that it has coherent idealist solutions. Let's consider two objections to *Backward Projection* that are independent of worries about laws.

The first objection is that *Backward Projection* is parasitic on the solution to a different truthmaker problem that cannot itself be solved in a way analogous to *Backward Projection*. Suppose we want to ground the existence of dinosaurs using *Backward Projection*. We'll have to say that there are dinosaur bones and other apparent traces of the prehistoric past around, and these traces, when assembled into a coherent picture according to the laws of nature, entail that a specific number of dinosaurs visited various places during the Jurassic. But note

[39] In principle, there are two ways for the idealist to argue that human prehistory also involved finite minds. First, the idealist can assume that all physical objects are parts of the body of some mind. Leibniz seems to have believed this (Adams 1994: 241–53). This theory entails that dinosaurs, prehistoric volcanoes etc. also had minds in some sense, therefore (6) is a complex fact about experience, with minds and occurrent mental states as truthmakers. Or the idealist can say that facts like (6) are facts about the experiences of supernatural minds (e.g angels) who witnessed the whole of prehistory. I ignore these appeals to exotic other minds, because it seems to me that they presuppose theism (in the angelici case) or some sort of plenitude principle (in the Leibnizian case), and these principles, as we'll see, can solve the problem by themselves.

[40] Descartes, although not an idealist, seems to have believed this. In Discourse 5, once he outlines how the planets formed, he adds: "I did not wish to infer from all these things that this world had been created in the way I described, for it is very much more likely that, from the beginning, God made it as it was to be. But […] provided that he had established the laws of nature and lent it his preserving action to allow it to act as it does customarily, one can believe, without discrediting the miracle of creation, that in this way alone, all things which are purely material could in time have made themselves such as we see them today" (Descartes 1968: 64).

that this explanation crucially depends on the assumption that there are buried dinosaur bones and other traces around. But nothing guarantees (and, indeed, one would ordinarily think that it is in fact false) that every single dinosaur left some trace that we can (or will) dig up. So *Backward Projection* cannot ground a fully determinate, complete prehistory.

The second objection to *Backward Projection* is that it secures a determinate past only if the initial state of human history, together with laws, is compatible with only one possible prehistory. But this is unlikely if the laws of nature are indeterministic. Indeterministic laws can generate the same state from different prehistories. If our world is indeterministic, then the fact that a tribe of immaterial minds woke up one day in a phenomenal environment resembling Africa is compatible with different backward-projected prehistories. In indeterministic cases, *Backward Projection* only tells us that something like (8) was *probable*. But facts about the past are not meant to be probabilistic.[41]

The idealist can meet these objection in two ways, in a sparse Humean way or in a theistic way. The Humean solution itself has two variants.

The gist of the Humean solution is to insist that the truthmakers for prehistory are our acts of observing traces of the (unreal) past. The Humean idealist can uphold this principle in two ways. First, she can admit that there aren't enough traces around to ground a fully determinate prehistory (even if we dig up all the dinosaur bones that we can) and that there are only probabilistic truths about large chunks of the past if indeterminism holds. But the Humean can go revisionary here and say that the remote past may be far less determinate than we ordinarily think. And she can add that (i) there are other ontologies that yield the same result (e.g. some versions of presentism), (ii) idealism secures all truths about the past that we have and will infer on the basis of the traces we actually observe.[42] So the sparse revisionary Humean idealist can nonetheless accommodate all our justified claims about the past.

Alternatively, the Humean idealist can adopt a *principle of plenitude* and say that there are so many traces of the remote past around that *Backward Projection* can ground a fully determinate past if determinism holds or the overwhelmingly high probability of a specific fully determinate past if indeterminism holds (the latter claim might be further supported by considerations about the decrease of entropy as we move toward the distant past).

[41] In principle, the idealist could also claim that (8) is a conditional about the potential experiences of time travelers (with some daleks thrown in, perhaps). This theory is subject to a worry similar to the first objection to *Backward Projection*. Something must make it true now that when I travel back 150 million years, I'll see a Brontosaurus at the place where the Big Ben stands today. One will either need contemporary truthmakers for the potential experiences of time travellers, or, if one locates the truthmakers in the past, one has to postulate a time traveling witness for every prehistoric event.

[42] Thanks to Barry Dainton for emphasizing this point.

Alternatively, the idealist can reach for the theistic formulation of idealism introduced in 1.2.2 and officially formulated in 1.3.11 (I'll use the basic version from 1.5 for simplicity):

<u>Ideality</u> *(theistic version):*

(IT) O is ideal $\approx_{df}$
$\Box$ O exists $\supset$ God is causing or is disposed to cause subjects to observe O.

(IT) generates the following alternative to (8):

(9) God was disposed to cause subjects to observe a Brontosaurus at p_{BB} at $t_{-150\mathrm{M}}$.

To secure truthmakers for (9), the theist idealist might suggest the following:

<u>*Divine Intentions:*</u>

(9) is true because God was disposed to cause humans specific types of experiences in case humans came into being (that is, in case God had decided to create them) earlier.

The upshot of *Divine Intentions* is that God has a certain story about the physical world as a seemingly autonomous system. Facts about prehistory are facts about this divine conception, entailing dispositions to cause subjects experiences of specific types. Hence, on this theistic version of idealism, the truthmaker for prehistory is God.[43]

It might be objected that *Divine Intentions* cannot secure the kind of prehistory that a sane physical ontology needs. Intuitively, when we claim that dinosaurs roamed the Earth, we are not talking about God's unmanifested dispositions to cause immaterial mental states. Neither are we talking about the divine conception of the physical world as a seemingly autonomous system. When we say that dinosaurs roamed the Earth, we mean that dinosaurs were *here*, breathing the same air we breathe, and leaving their bones behind when they died. *Divine Intentions* cannot secure such facts about prehistory; it can only secure a ghostly, unreal past.

This complaint can be understood in two ways. On one reading, the complaint asserts that dinosaurs were real. This boils down to the assertion that our intuitions demand a physical realist ontology. Idealists lack such intuitions and they deny that such intuitions are reliable.

On a different reading, the complaint is that the content of our intentional states about dinosaurs does not match the kind of content that the theist idealist

[43] Or, rather, the truthmaker is the state of God's having a certain conception of our prehistory. God's existence only necessitates our prehistory if God necessarily creates a world like ours, which is implausible. Generally, truthmakers cannot be concrete objects but only states thereof (cf. Merricks 2007: 17–22). Let me ignore this subtle point.

attributes to them. When we think about dinosaurs, we think about big-boned prehistoric lizards that used to inhabit this planet and are causally connected to us through a long and ramified chain of influence. In contrast, the theist idealist asserts that our intentional states about dinosaurs refer to the contents of the Divine Mind. This sounds like a gross misconstrual of the contents of our thoughts. Or so the physical realist can argue.

The theist idealist can reply the following: When we think about dinosaurs, we imagine what dinosaurs looked like and we try to form a conception of their biology and evolutionary history. These are precisely the kind of contents that our dinosaur-directed intentional states would have had if we had come into being during the Jurassic and had the chance to explore the environment. Assuming that God is the cause of our experiences, it follows that the contents of our (true) dinosaur-directed thoughts are very similar to the contents of the experiences that God would have caused us if we had been around in the Jurassic. So *Divine Intentions* does not misconstrue the content of our dinosaur-directed thoughts. It only violates the physical realist intuitions that typically accompany these thoughts. But the idealist lacks such intuitions and she denies that such intuitions are reliable.

4.1.2 Truthmakers for the present

The existence of unobserved contemporary objects gives rise to a similar but subtly different dialectic. Suppose that nobody is in room 412 right now and the following proposition is true:

(10) There is a table in room 412 now.

On the standard definition of ideality, (10) entails that

(11) A table in room 412 is now observed or observable by someone.

If nobody is in room 412 now, (11) reduces to:

(12) A table in room 412 is now observable by someone.

Generally, the existence of unobserved contemporary objects will require truths like (12) under the standard definition of ideality. As before, it isn't easy to see how the idealist can supply the requisite truthmakers. The idealist might suggest the following:

Forward Projection:

(12) is true because the laws of nature, when projected forward from an earlier moment when someone saw a table in room 412, yield the conclusion that those who now enter 412 will see a table.

Forward Projection is subject to the same initial complaint as *Backward Projection*: it requires an idealist account of laws. Let's bracket this issue until 4.2. Then *Forward Projection* is still open to an important objection.

Forward Projection is predicated on the idea that earlier phenomenal facts can ground later physical facts, because, together with the laws, they entail determinate truths about potential experience. For example, some subjects may have had the experience of buying a table, taking it to 412, assembling it there, other subjects may have recently visited room 412, observing a table there etc. *Forward Projection* implies that these sensory episodes, when assembled into a coherent picture according to the laws, entail (12). But this theory, an interloctur might argue, only generates a determinate physical world if all physical objects that exist now have been observed at least once.[44] It is unlikely that our past is so rich in phenomenal detail. For example, we have no reason to think that we have observed all planets, grounding later facts about the structure of the cosmos.[45]

As before, there are Humean and theistic strategies available, and the former now comes in *three* versions. The sparse Humean idealist can insist, first, that the truthmakers for the present are the occurrent experiences of minds but admit that this can only secure a "gappy" present, and hence our world is less determinate than we ordinarily think. Alternatively, the sparse Humean idealist can say that the truthmakers for the present include *all* actual experiences (past, present, and future), and hence we have truthmakers for all truths about objects that humans will ever observe. Since the Humean idealist will put future experiences to good use in her account of laws anyway (see 4.2.1), this move fits naturally into her ideology. Third, the sparse Humean idealist can reach for the same *principle of plenitude* that was mentioned in 4.1.1 and assume that the world is rich enough in experiences for *Forward Projection* to ground a fully determinate present.

As before, theistic idealism has a different, but equally coherent, story to tell. On the definition of theistic idealism, (10) entails that

(13) God is now causing or is now disposed to cause subjects to observe a table in room 412.

Coupled with the assumption that there are no observers in 412, (13) entails the following condition for the existence of the table:

(14) God is now disposed to cause subjects to observe a table in room 412.

The upshot of (14) is very similar to the upshot of *Divine Intentions*. It implies that God has a detailed conception of our world, and, on the basis of that conception, He is disposed to cause us experiences of specific types. This theory allows the idealist to claim that the truthmaker for (10) is God.

[44] Perhaps it is enough to say that only traces have been observed (e.g. seeing smoke in the distance may be enough to ground the existence of a fire far away). But those traces must be so numerous that they are unlikely to invalidate the objection at hand.

[45] Note that *Forward Projection* is not subject to the complaint about indeterministic laws. If laws are indeterministic, then (10) will only entail that (12) is probable, and *Forward Projection* can generate this result.

As before, the physical realist can complain that God is not the kind of truthmaker that we intuitively associate with physical truths. And as before, the idealist can explore two readings of this complaint.

On the first reading, the complaint appeals to physical realist intuitions. Since the idealist lacks such intuitions and she thinks that such intuitions are unreliable, this version of the complaint is ineffective.

Alternatively, the complaint can be seen to highlight a mismatch between the content of our world-directed thoughts and the idealist construals of those thoughts. When we think about tables, we think about hunks of matter located in space. We do not think about the divine conception of the world. Hence, treating God as the truthmaker for truths about tables etc. misconstrues the contents of our world-directed thoughts.

The theist idealist can reply the following: When we think about unobserved physical objects, we imagine what they look like and we try to form a coherent conception of their structure. These are precisely the kind of contents that would characterize our phenomenal states, and the inferences we make on the basis of them, if we were actually observing the objects in question. Assuming that God is the cause of our experiences, it follows that the contents of our (true) thoughts about unobserved physical objects are similar to the contents of the experiences that God would cause us if we were observing the objects in question. So treating God as a truthmaker for (10) does not misconstrue the content of our world-directed thoughts. It only violates the physical realist intuitions that typically accompany those thoughts. But the idealist lacks those intuitions and she has no reason to be intimidated by them. So neither of the two interpretations of the complaint at hand has a purchase on the contention that God is the truthmaker for truths about unobserved physical objects.

4.1.3 Summary of 4.1

I have argued that idealism can supply truthmakers for physical facts in two ways, by committing to a (possibly revisionary) sparse Humean version of idealism or by going theist. In 4.1.1, I examined truths about prehistory. I argued that *Backward Projection* can ground a sparse Humean version of idealism on which the past is either less determinate than we ordinarily think or (if one adopts a suitable principle of plenitude) it is, or could very well be, fully determinate. Alternatively, the idealist can go theist and say that the truthmaker for prehistoric truths is God. I defended this thesis against two complaints, one that appealed to physical realist intuitions and one that charged the idealist with misconstruing the content of our past-directed thoughts. In 4.1.2, a similar dialectic unfolded about currently unobserved physical objects. I claimed that the sparse Humean idealist can adopt *Forward Projection* while the theist idealist needs no further resources beyond those pointed out in 4.1.1.

4.2 Laws

One common objection to idealism is that it cannot explain the laws of nature. The basic intuition seems to be that once everything is reduced to experience, there is no reason why our experiences should conform to one kind of order instead of another—there is no external reality that constrains which kinds of experiences can succeed one another. Here's a detailed exposition of this complaint by Laurence BonJour:

> *Why*, according to the [idealist], are the orderly sense-data in question obtainable […] ? What is the *explanation* for the quite complicated pattern of actual and obtainable sense experiences that, according to [idealism], constitutes the existence of a material object or of the material world as a whole, if this is not to be explained by appeal to genuinely external objects? The only possible [idealist] response to this question is to say that the fact that sensory experience reflects this sort of order is simply the most fundamental fact about reality, not further explainable in terms of anything else. (BonJour 2011: 2.1)

In the original text, Bonjour refers to phenomenalism instead of idealism, but his complaint can be applied to idealism without any further ado.

Note that Bonjour's complaint only has bite if the physical realist is not faced with the same problem. The physical realist must establish that laws of nature *are* explained by the existence of real physical objects. J. L. Mackie explains why this is the case

> The postulation that each material object has some intrinsic quantitative feature which reacts contingently but lawfully with imposed forces is just what we need to explain the otherwise remarkable coincidence that [specific instances of the same Newtonian law] hold for all objects. (Mackie 1973: 151)

Suppose, for illustration, that Newton's law of gravitation is indeed a law, and consider two balls, ball *A* (mass: 1 kg) and ball *B* (mass: *m* kgs), located 1 meter apart. Newton's law of gravitation tells us that *A* will attract *B* with a force of *Gm*, where *G* is a gravitational constant. No matter the magnitude of *m*, the force will be *Gm*. It follows that Newton's law sums up a nondenumerable infinity of specific rules about the relationship between distance, mass, and gravitational force. Mackie suggests that the hypothesis that *A* has a real intrinsic property (e.g. some quantity of mass) can explain why *A* obeys this nondenumerable infinity of specific rules. And this remarkable coincidence seems unexplained if there is no real matter at the place where *A* is and the rules in question just happen to co-obtain. Or so the physical realist can argue, and her contention certainly merits discussion.

To sum up, we have two distinct but complementary theses:

(15) Laws of nature are brute facts if idealism is true.

(16) Laws of nature can be explained by the presence of real matter.

If both (15) and (16) are true, then we have reason to prefer physical realism to idealism. (More precisely, we have reason to do so if we value the explanatory power of metaphysical theories. We may assume this for the sake of argument.) On the other hand, if one of (15) and (16) is false, then we have no reason to prefer physical realism to idealism, as far as laws are concerned.

To clear the ground, let me note, and push aside, two easy idealist rejoinders to (15). An easy theist idealist rejoinder would be that our world has the laws it does because of God's providential concerns. Laws of nature are not brute facts because God had some purpose in mind when He instituted them.[46]

In response, the physical realist can agree that, if theism is assumed, then laws were designed by God on the basis of specific providential plans. But this fact does not help the idealist solve the nomic objection, because the fact that God had certain reasons for instituting these specific laws does not constitute a *metaphysical* explanation of laws. It does not tell us what it is about physical objects that makes them conform to a highly coherent and extremely complex set of laws. The physical realist thinks she has a good story to tell about this. For example, she can join Mackie and claim that quantities of real mass glue specific instances of Newton's third law together. But the idealist does not seem to have a similar story to tell about the metaphysics of laws. To make matters more difficult for the idealist, I'll assume, therefore, that (15) cannot be denied by reference to God's providential plans.

Another easy rejoinder to the nomic objection would be the comment that, on a number of respectable theories of the metaphysics of laws, laws *are* brute facts, regardless of the truth or falsity of idealism.[47] If these theories are sound, then (16) is false, and the nomic objection against idealism is undermined. But, as before, I will not assume that this move settles the debate, because the nomic

[46] It is interesting to note that this suggestion, although it does not solve the nomic objection, is nonetheless present in the history of idealism. Berkeley (*New Theory of Vision* §147, I: 231) thinks that the laws of nature serve the aid and comfort of mankind. Leibniz, prefiguring the "best system" account of laws advocated by Ramsey and Lewis (see p.113 below), claimed that God chose those specific laws that He did because "simplicity of the ways [of nature] is in balance with the richness of the effects" as a result (*Discourse on Metaphysics* §5, Leibniz 1989: 38–9), in other words, the actual laws strike an optimal balance between simplicity and strength. Even non-theistic forms of idealism can derive laws of nature from cosmic teleology. The idealistic Yogācāra school of Buddhism explained laws by reference to our karma and our collective recollection of past lives (see section XXXII of Vasubandhu's *Viṃśatikā* in Tola and Dragonetti 2004: 113–4, 147–8).

[47] Brutal lawhood is endorsed by Carroll (1994), Lange (2009), and Maudlin (2007), among others. Note also Foster's (2003) argument that all non-theistic ontologies must treat laws (and the validity of induction) as ultimately unexplained.

objection can be reformulated by conjoining it with the denial of some premise or intuition that motivates the theory of brute laws. I'll assume that laws of nature are not brute facts but need some sort of explanation, and I'll grant the physical realist (16), the claim that physical realism can explain laws.

With these preliminaries in place, let me outline my dialectic against premise (15) of the nomic objection, which is the thesis that the idealist cannot explain laws. In 4.2.1–4.2.3, I examine three different metaphysical accounts of laws. In 4.2.1, I focus on Humeanism about laws. In 4.2.2, I look at the theory of laws as relations between universals, and in 4.2.3, I discuss laws derived from powers. I'll argue that the idealist can tailor each of these theories to her own ontology, generating an explanation of laws that is at least as good as its physical realist counterpart. Consequently, we have reason to think that (15) is false.

Needless to say, I don't expect the following dialectic to settle all problems about the nature of laws in idealism. A thorough treatment of this topic would require a separate dissertation. But, arguably, the force of the nomic objection is severely diminished if (15) turns out to be false under three very different and influential conceptions of laws. Minimally, this indicates that the nomic objection presupposes some special theory of lawhood or some other nontrivial premise hidden, so it cannot constitute a straightforward objection to idealism.

4.2.1 Humean laws

On Humean conceptions, laws of nature reduce to global regularities. However, sane Humeans do not straightforwardly identify laws with regularities, because some regularities are accidental. There are no mountains of gold and no mountains of uranium, but the nonexistence of the latter is a law while the nonexistence of the former isn't. Moreover, not any old regularity is fit to be a law, even if we rule out accidental regularities. For example, the conjunction of Einstein's field equations with the axioms of set theory is not a law, even though it entails a huge number of non-accidental exceptionless regularities. To see the general challenges in this vicinity, consider the most developed contemporary Humean account of laws, that of David Lewis:

> I adopt as a working hypothesis a theory of lawhood held by F. P. Ramsey in 1928: that laws are "consequences of those propositions which we should take as axioms if we knew everything and organized it as simply as possible in a deductive system." […] What we value in a deductive system is a properly balanced combination of simplicity and strength—as much of both as truth and our way of balancing will permit. We can restate Ramsey's 1928 theory of lawhood as follows: a contingent generalization is a *law of nature* iff it appears as a theorem (or axiom) in each of the true deductive systems that achieves a best combination of simplicity and strength. (Lewis 1973: 73)

This theory implies the following protocol for determining the laws of a possible world *W*:

(H1) We write down all the (concrete) facts of *W*. Let's call the resulting class of propositions "Φ."

(H2) We write down all systems of general propositions that (together with initial conditions) entail only propositions in Φ. Let's call the resulting class of systems "Σ."

(H3) We take the intersection of those members of Σ that entail the greatest part of Φ at the price of the least amount of complexity. Let's call the resulting set "*S*."

(H4) *S* is the system of Humean laws (H-laws) in *W*.

There are a number of well-known complications about this protocol. The first is that it is unclear what guarantees that step (H3), the step where we pick a specific best system, can be carried through. Formally, the complaint says that we have no reason to think that set *S* in (H3) is not empty and that it contains enough laws to explain all lawlike phenomena. Less formally, the complaint is that nothing seems to guarantee that any specific system strikes the optimal balance between simplicity and strength or that only one does. If there are only suboptimal systems (e.g. exceedingly complicated ones or ones that do not cover enough particular facts) or if two or more systems tie for optimality in some world *W*, then, by (H1)–(H4), *W* has no H-laws.

A second, related problem is that it is unclear whether the demands of unity and simplicity are free from anthropocentric bias. Perhaps a system *S* that looks very simple to us looks very complicated to Martians. If the property of being simple is subject to such perspectival bias, then a world *W* might have different H-laws depending on who runs the protocol. And even if one admits a notion of objective simplicity, it is far from clear that what is objectively simple is also simple for us.

A third problem about H-laws is that worlds that contain relatively few facts will contain relatively few H-laws. To see why this is trouble, take a world *W* that contains nothing but a single electron, motionless in a space that lacks any electric fields. Intuitively, this scenario seems coherent. However, this scenario entails that some laws in *W* are uninstantiated—for example, the law that electrons are attracted by protons is uninstantiated in *W*. Once we assume that the object that inhabits *W* is an electron, it seems hard to deny that it is a law in *W* that electrons are attracted by protons. In any case, it does not seem logically incoherent to make that assumption. But it is clear that the H-laws of *W* will not include the law that electrons are attracted by protons.

Whether these objections wreck Humeanism about laws is an open question.[48] I will not argue either way. I only mention these issues in order to indicate the kind of problems that the idealist does *not* have to worry about once we assume that the laws of nature are H-laws. If the laws are H-laws, then the problems I've just outlined are problems for physical realists and idealists alike, hence they are irrelevant for evaluating the comparative merits of idealism and physical realism in the context of Humeanism about laws.

Let's assume, then, that rules (H1)–(H4) are set in stone as far as lawhood is concerned and all general objection to (H1)–(H4) have been answered or laid aside. The question now is whether the physical realist has an easier time construing laws as H-laws than the idealist.

The gist of Humeanism about laws is that laws supervene on the global distribution of local occurrences. If pieces of radium typically turn into radon over time throughout the history of a physical realist world, then it will be a law, or a consequence of some laws, that radium decays into radon. Let's see whether the idealist can hijack this idea.

Here's a straightforward idealist way to construct H-laws about radium: Observations of radium are typically followed by observations of radon, with subtle and stable correlations between these two types of observations (e.g. there is a stable regularity about changes in mass). Hence, assuming that our world is idealistic, it will be an H-law, or a consequence of some H-laws, that radium (conceived as an ideal kind) decays into radon over time.

Generally, given a rich stock of experiences, H-laws can be generated in idealist worlds just as well as in physical realist worlds. So physical realism does not have an explanatory advantage over idealism in terms of explaining laws if the laws are the H-laws.

It might be objected that there may not be enough experiences to ground some H-laws, because some laws might lack observed instances. If this complaint is sound, then the idealist can only generate an impoverished stock of H-laws. This complaint, in turn, can be interpreted in two different ways. On the first interpretation, the complaint is that in small worlds (e.g. in a world containing only a few subjects), the stock of experiences will be so meagre that idealist H-laws cannot be expected to cover all physical laws.

[48] On the mind-independence of H-laws, see Lewis (1994: 479) and Loewer (2004: 185–7). On the problem of simple worlds, see Loewer (2004: 192–4). I am not aware of Humean responses to the objection that there may not be a unique best system. Perhaps Humeans are willing to live with this consequence but they assume, by abduction from actual physics, that our world does have a unique best system. Note also that even if the three objections are impossible to rebut, the Humean can argue that laws should be identified with H-laws. Lewis himself used H-laws to build an elegant account of counterfactuals (H-laws ground closeness of possible worlds, cf. Lewis 1973: 74–5), which, in turn, yielded a powerful account of causation (Lewis 1986a: 23, 1986b: 164–5, 2000). Problems about H-laws may be outweighed by the theoretical utility of H-laws.

In response, the Humean idealist can reply that we buy into this problem once we buy into H-laws. We saw in connection with the lonely electron that the physical realist Humean has a similar problem about uninstatiated laws. So the complaint at hand does not seem to be a complaint about idealism.

Alternatively, it might be objected that the H-laws of our *own* rich world are hard to generate under idealism, because there will be much fewer concrete facts that go into Φ in (H1). Suppose that the world ends tomorrow. Then the concrete facts of our world are facts about the phenomenal history of a few billion humans. By contrast, if physical realism is true, then history includes facts about trillions and trillions of elementary particles. It might be argued that the relative paucity of concrete facts under idealism makes it hard for idealists to generate all actual H-laws. Nothing guarantees that every physical law is instantiated at least once in the phenomenology of some subject.

In reply, the Humean idealist can argue that she can generate all the H-laws that are experimentally confirmed during the history of the world, so she can generate all H-laws that will ever be known. The existence of all the H-laws we'll ever know is guaranteed even if our world is idealistic, because laws can only be known on the basis of a sufficient stock of observations.

It might be objected that phenomena that are exceedingly hard to observe will not have enough observed instanced in idealist worlds, so the set of idealist H-laws will be impoverished anyway. Suppose that ξ-bosons are observed only a few times, so observation cannot ground idealist H-laws about ξ-bosons. Nonetheless, there might be laws about ξ-bosons.

In reply, the Humean idealist can say that statements can qualify as H-laws simply in virtue of cohering well with the other laws. Hence, even if ξ-bosons are very rarely seen, a general principle that mentions ξ-bosons may be a law in idealism by helping to achieve the optimum trade-off between simplicity and strength in the context of a specific deductive system.

Granted, the Humean idealist cannot admit laws that have never been subject to any kind of confirmation. For example, the Humean idealist cannot generate H-laws laws about Unobtanium$_{140}$, a substance that is found in remote parts of the galaxy and cannot interact with anything we'll ever know of. But it is unclear whether this is a bug or a feature. After all, the Humean intuition is that laws depend on widespread regularities. Hence, laws of idealist worlds will depend on widespread phenomenal regularities. If there are no phenomenal regularities concerning Unobtanium$_{140}$, then a self-respecting Humean idealist will conclude that there are no laws about such a substance, just as a Humean physical realist will say that there are no laws about Unobtanium$_{140}$ in worlds that do not contain Unobtanium$_{140}$.

Moreover, the Humean idealist can press the point that her theory gives us all the laws that science will ever discover. Hence, the theory fulfills the minimal requirement on any decent of metaphysics of laws: it accounts for all the results of science.

Finally, it might be objected that the deductive systems that we are inclined to identify with the laws of our world (e.g. Einstein's field equations, or the laws of quantum mechanics) are not statements about experience. They are statements about physical structures, expressed in a mathematical form. Hence, idealism cannot give us actual H-laws, because actual H-laws are mathematical statements about physical structures, while the H-laws of idealist worlds are statements about experience.

This complaint rests on the misconception that the idealist is obliged express every physical fact in terms of facts about phenomenal states. But it is hard to see why she should be. The idealist can agree that our candidate laws are mathematical statements about physical structures while maintaining that those structures are ideal. It is certainly not obvious that they are ideal, because it is all too easy to reify our notion of the physical into something purportedly real. But this fact in itself does not invalidate the idealist take on H-laws.

To sum up, Humean idealism is not vulnerable to the complaint that the stock of phenomenal facts is too sparse. If laws are H-laws, then idealist worlds will contain all the laws that scientists in those worlds will ever discover. Demanding more betrays an unHumean bias that has nothing to do with the relative merits of idealism and physical realism in the context of Humeanism.

4.2.2 Laws as second-order universals

An influential, and markedly unHumean, account of natural laws identifies laws with relations between universals.[49] For an illustration, imagine an unripe plum. One can think of *being an unripe plum* as a complex universal composed of further universals like *being green*, *being sour* etc. When the plum ripens, it ceases to instantiate some of these universals and starts to instantiate others. *Being green* is replaced by *being dark blue*, *being sour* is replaced by *being sweet* etc. Those who conceive of laws as relations between universals invite us to think of this process by thinking of *being an unripe plum* and *being a ripe plum* as two (complex) universals that are linked by a nomic necessitation relation (which is also a universal, but a second-order one). Whenever *being an unripe plum* is instantiated (in normal circumstances), it drags its nomic complement, *being a ripe plum*, into existence via the nomic necessitation relation. Generally, the theory of laws as second-order universals says that lawlike regularity arises because universals are connected to each other through nomic necessitation relations, forcing the instantiation of further universals.

[49] The classic sources are Dretske (1977), Tooley (1977), and Armstrong (1983, 1997).

There are a number of well-known objections to this theory. David Lewis famously complained that calling a relation "nomic necessitation" does not give us a grip on what laws are any more than calling someone "Armstrong" can guarantee that the person in question has mighty biceps (Lewis 1983: 366). There are other, more technical objections as well.[50] I bracket these problems, because my goal is not to amend or criticize the theory at hand. The question is whether it puts the physical realist at an advantage.

One might try to adapt the theory of second-order universals to idealism by telling a story about links between universals that characterize the experience of immaterial subjects. One might suggest that whenever a subject looks at an unripe plum, her mental states involve various universals that qualify her visual experience as the experience of a small elliptical greenish object. Let's call the universal that characterizes this experience as a whole "E_1." The idealist might suggest that E_1 is linked via a nomic necessitation relation to another universal, E_2, which characterizes the visual experience of a ripe plum (of the same size etc.). When ideal plums ripen, E_1 is replaced by E_2 in the phenomenology of observers. The fact that ideal plums ripen is explained by the second-order universal that links E_1 to E_2.[51] This is the first-pass idealist version of the theory of laws as second-order universals.

There are two problems with this story. The first is that it does not explain how unobserved plums come to ripen. The story is hard to adapt to the case when an unripe plum hangs from an unobserved tree and becomes ripe without anyone looking.[52] The story I outlined implies that all physical objects that are subject to lawlike change are observed all the time, which is incredible.

Another, more subtle problem concerns phenomenally indiscriminable states. Suppose that a certain greenish piece of wax *G*, when looked at from a certain angle, looks exactly like an unripe plum. Subjects who look at *G* are in the same phenomenal state as subjects looking at an unripe plum. If E_1 is the universal that characterizes the visual experience of an unripe plum, then, by hypothesis, E_1 is also the universal characterizing the visual experience of *G*. If a nomic necessitation relation links E_1 to E_2 (the universal corresponding to the visual experience of a ripe plum), then it follows that those who look at *G* long enough

[50] E.g. van Fraassen (1987) argues that the theory cannot account for probabilistic laws.

[51] To be absolutely precise, one should emphasize that the ripening depends on environmental factors. Strictly speaking, the universal corresponding to the experience of an unripe plum is linked to the universal corresponding to the experience of a ripe plum together with various other universals that guarantee that the environment is conducive to ripening. Let me ignore this complication.

[52] Note that, on the present definition of idealism, there can very well be unobserved plums. All that one needs for the existence of unobserved plums is that they be observable (or that God be disposed to cause subjects to observe it). Idealism itself is not threatened by unobserved plums. What is problematic is the idealist explanation of ripening in terms of relations between universals that characterize sensory experience.

will see it turn into a ripe plum. This is wrong. So the first-pass attempt at an idealist reading of the theory of laws as second-order universals fails.

Consider the following, alternative, theory: We conjoin idealism with theism and we assume that subjects instantiate various phenomenal states in virtue of standing in specific (causal) relations to God, with these relations, in turn, conceived as universals. Suppose, further, that the causal relations between God and finite subjects are underwritten by God's conception of the sensible world. If a subject instantiates E_1 while having the visual experience of an unripe plum, she stands in an appropriate causal relation R_1 to God, and there is a corresponding intention or structural conception S_1 in God's mind such that the existence of S_1 entails that God will bear R_1 to subjects under specific circumstances (e.g. when someone looks at a plum tree in spring). And there is another intention or structural conception S_2 in God's mind, linked to S_1 in such a way that once God enters into R_1 with subjects, God is then disposed to enter into another relation R_2 with subjects, with R_2 entailing that subjects will later instantiate E_2 and have the visual experience of a ripe plum.

This theory construes laws as second-order universals in the sense that God is assumed to have the same intention or structural conception about numerically distinct but qualitatively identical plums, so the relation between S_1 and S_2 crops up repeatedly in God's conception of the world, and laws about ripening are indeed relations between universals. The theist idealist may even assume that S_1 and S_2 involve the relevant phenomenal universals as well, so that E_1 to E_2 are also linked through a lawhood-conferring relation.

The theist idealist take on the theory of laws as second-order universals is not open to the objections that wreck the first-pass attempt. Let me return to those objections in turn.

Physical objects that are subject to lawlike change need not be observed all the time in the theist idealist story. The only requirement is that God have a determinate conception of all the physical objects that exist.

The objection from phenomenally indistinguishable states has no bite either. Suppose that Alice is looking at a greenish piece of wax G. Her phenomenology is characterized by the same universal, E_1, that she would instantiate if she were looking at an unripe plum. On the theist idealist story of laws as second-order universals, what happens when Alice is looking at G is that she instantiates E_1 in virtue of bearing a certain relation R_G to God, and this relation, in turn, obtains because God has a certain intention or structural conception S_G in mind. The objection is blocked because the theist idealist has no reason to suppose that S_G is the same intention or conception that underlies our experience of unripe plums. Specifically, the theist idealist can say that S_G is linked to intentions or conceptions that entail that God will cause us waxlike experiences later.

Therefore, even though the same phenomenal state, E_1, figures in both God's conception of plums and in His conception of plumlike pieces of wax, these two conceptions are distinct. God's conception of *G* does not entail the later visual experience of ripe plums, because S_G is not nomically connected to God's conception of ripe plums. The theist idealist can rebut the objection from phenomenally indistinguishable states because, unlike the atheist idealist, she does not have to assume that the second-order universals that underlie laws link phenomenal qualities directly.

4.2.3 Laws from powers

Finally, consider a second unHumean theory of laws, the theory that laws derive from the intrinsic powers possessed by the objects falling under laws.[53] For example, one can conceive of electrons as having an intrinsic power, the power of attracting positively charged particles. The laws of electricity will then be the consequences of such powers. Or, to return to the previous example, one can conceive of unripe plums as having an intrinsic power, the power to ripen. This power is naturally activated when circumstances are normal, resulting in the observed regularity that unripe plums tend to ripen. Generally, one can think of laws as grounded in the powers of objects, with powers conceived of as intrinsic properties that entail, but are not reducible to, conditionals. (One can think of powers either as universals or as tropes. This issue is unimportant in the present context.)

At a first pass, the idealist might try to adopt power-based laws to her own ontology by arguing that immaterial subjects have certain primitive perceptual powers (for example, the power to have visual experiences various kinds, the power to have auditory experiences etc.), and laws arise when these powers are activated. The idealist might argue that our perceptual powers have a very similar overall structure, hence their activation gives rise to the experience of a shared orderly world.

There are two problems with this story. The first is that it is unclear what activates primitive perceptual powers in this conception. Presumably, our primitive perceptual powers don't get activated just by themselves, and it is also implausible to suggest that we activate each other's perceptual powers, since even though we can initiate changes in each other's phenomenology, we are not responsible for the whole content of each other's experiences of the physical world, or, at any rate, it is hard to see how we could be.

But even if we disregard this issue, the existence of primitive perceptual powers cannot explain the existence of laws. To see why, suppose that Adam and Eve are the only inhabitants of an (ideal) island. In the middle of the island, there

[53] See e.g. Bird (2007) and Ellis (2001).

is an object *O* whose existence reduces to facts about the primitive powers of Adam and Eve. Eve thinks that *O* is a tree. Her belief that *O* is a tree is warranted by appropriate tactile and audiovisual experiences that lawfully accompany her attempts to approach and examine *O*. Adam, on the other hand, thinks that *O* is a stationary rhinoceros. His belief that *O* is a stationary rhinoceros is likewise supported by appropriate phenomenal regularities that are lawfully correlated with his actions. Finally, let's suppose that this incoherence is undetectable. When Eve climbs the tree, Adam sees her climbing a rhino, when Adam remarks that the rhino is very friendly, Eve hears a remark about a tree or hears nothing (without this lapse in the conversation registering for either of them) etc.

This scenario is compatible with the existence of perceptual powers, but in this scenario, *O* is not a public tree and not public rhino; it is a tree for Eve and a rhino for Adam. As a result, there cannot be physical laws about *O* (or at least not laws that are relevantly like the actual ones) because *O* is not a determinate physical object. The scenario is easy to generalize, hence he existence of laws requires something extra over and above the existence of primitive perceptual powers in idealism. It requires a certain harmony in the way that the experiential powers of subjects are activated. This extra requirement, in turn, wrecks the proposed explanation. If laws ultimately depend on the harmony between the way powers are activated, then powers play a subordinate role: they are the items that need to be in harmony in order for there to be laws. The nomological heavy lifting is done by the harmony and not by the powers. And since harmony does not arise from the existence of primitive perceptual powers, the story at hand is a brute-fact theory of laws in disguise.

The theist idealist is, again, in a better position to deflect this objection. The theist idealist can deflect this objection by arguing that, given God's decision to create a physical world, the perceptual powers of subjects are guaranteed to be activated in a harmonious way. Let me elaborate.

If the perceptual powers of subjects are activated in a non-uniform fashion in an idealist world, then subjects cease to inhabit a common physical world and start inhabiting a number of loosely overlapping individual environments. To see why, suppose that the representational incoherence that affects Adam and Eve is a bit more pervasive. Adam thinks that the island is filled with coconut trees and Eve thinks it is filled with banana trees, without this discrepancy registering for them. Whenever Adam picks a coconut, Eve sees him pick a banana, whenever Eve hands Adam a banana, Adam has the experience of receiving a coconut, whenever Adam makes a remark about coconut trees, Eve hears a remark about banana trees etc. And suppose that this kind of hidden incoherence is pervasive, so that, in fact, there is nothing common in Adam's and Eve's conceptions of their environment beyond the idea that they live on an island. Clearly, Adam and Eve do not inhabit a common physical world in that case—they live in their own individual environments that are loosely correlated but fail to mesh into a common world. Since the physical is public, it follows that there is no physical world in the world of Adam and Eve in this scenario. And since this example is easy to generalize, it follows that there is no physical world in idealist worlds where the perceptual powers of subjects are activated in a non-uniform fashion.

Consequently, the theist idealist can argue that, given God's decision to create a physical world, it is *a priori* guaranteed that the perceptual powers of subjects are activated in a harmonious way and hence there are laws. (Note that physical realism cannot generate the same result. There is no reason why a real physical world could not be totally chaotic.)

One might object that this story ultimately appeals to teleology, specifically, it appeals to God's providential plans, and therefore it does not explain laws from powers. Powers are the metaphysical matter for an order that is imposed by God on the basis of providential concerns.

In response, the idealist may argue that the existence of laws must ultimately be explained by reference to God's providential plans anyway.[54] But even if this bold response is avoided, the idealist can reply that the harmony of powers is not automatically guaranteed on physical realism either. Consequently, the problem at hand is a general problem about the theory of power-based laws, and not a problem about the relative merits of physical realism and idealism in the context of power-based laws.

4.2.4 Summary of 4.2

Section 4.2 addressed the nomic objection to idealism. The gist of this objection was that idealism is inferior to physical realism because the idealist must treat laws as brute facts. I have examined three accounts of laws, a Humean one and two unHumean ones. In 4.2.1, I argued that the Humean idealist can ground laws just as well as the physical realist. In 4.2.2 and 4.2.3, I argued that laws conceived as second-order universals and laws derived from derived from powers or second-order universals can be conjoined with idealism if the idealist adopts theism.

I have not offered a comprehensive treatise on idealist laws. But I hope to have shown that the case for the nomic objection is not very strong. Humean and unHumean conceptions of lawhood can alike be adapted to idealism. The only requirement seems to be that idealism must be conjoined with theism if the idealist goes unHumean.

[54] See Foster (2003) for an argument that the existence of laws entails theism.

4.3 Summary of Chapter 4

This chapter discussed two metaphysical objections to idealism. The truthmaker objection says that the idealist cannot supply truthmakers for truths about the physical world. In 4.1, I argued that this objection is can be met in two ways, by adopting a sparse Humean version of idealism or a theistic version of idealism. The nomic objection to idealism said that the idealist cannot explain the existence of natural laws. In 4.2, I argued that the nomic objection is weak because three very different and influential accounts of the metaphysics of laws seem equally well suited to serve an idealist ontology.

All in all, the dialectic of this chapter warrants the following conclusion: There are at least two coherent versions of idealism available, a sparse Humean one that is potentially revisionary with respect to our ordinary beliefs and a theistic one that can preserve most of our ordinary beliefs.

Appendix
Clock transport synchrony

Suppose we want to test the one-way speed of light using a transported clock. We set clocks *A* and *B* side by side at *P*, and we synchronize them locally. Then we transport clock *B* to $x = 1$, and, when *A* reads “0,” we send a light beam to *B*. Since the two clocks are synchronized, the readout on *B* when the beam arrives tells us the one-way velocity.

One important issue that one must take into account when thinking about this setup is that special relativity predicts that moving clocks will slow down. According to the predictions of special relativity (assuming uniform speed for light), if a clock is moved at v m/sec for t_A seconds (measured on a clock at relative rest), the time on the moving clock is given by

$$(1) \qquad t_B = t_A \cdot \sqrt{1 - v^2/c^2}$$

For example, if clock *B* is locally synchronized with *A* and then transported at a velocity of $0.4c$ to its remote location, then *B* will show roughly 0.811 times the time on *A* upon arrival.

We must correct for this discrepancy before we begin the experiment, otherwise the two clocks will not be in synchrony once *B* is transported to its remote location. For example, if *B* is transported to $x = 1$ (taking 1 unit distance to be c meters) at $0.4c$ after the clocks are set to 0 locally at $x = 0$, then *A* will read 2.5 seconds and *B* will read roughly 2.0275 seconds when *B* arrives (assuming standard one-way speed). In order for the two clocks to stay in synchrony, *B* must be reset by adding 0.4725 seconds after arrival.

It is easy to anticipate how the dialectic develops from this point. Since the time on *B* must be corrected after arrival for the two clocks to stay in synchrony and the correction factor involves the velocity of light, we cannot re-sychronize *B* with *A* after *B* is transported without assuming something about the one-way velocity of light and thus begging the experimental question. Let’s see how this problem emerges in a simple 2D spacetime.

Suppose we synchronize *A* and *B* locally, we transport *B* at velocity v to a remote location, then we re-synchronize *B* with *A* using the standard formula mentioned above. As Winnie (1970) explains in his seminal paper on deviant models of special relativity, two things go wrong in this process if the speed of light is not uniform. First, the slowdown of *B* will given by

$$(2) \qquad t_B = t_A \cdot \sqrt{1 - v^2/c^2} \cdot \frac{c}{c + v(2\varepsilon - 1)}$$

, where 2ε is the ratio between the average round-trip speed of light, *c*, and its speed in the direction in which *B* moves (Winnie 1970: 85, 89–91).

To simplify, let's express (2) as

$$(3) \qquad t_B = t_A \cdot \sqrt{1 - v^2/c^2} \cdot \text{fudge factor}$$

This formula abbreviates the fact that in deviant models, the standard time dilation formula, (1), is modified by a factor that depends on the speed of light in the direction of *B*'s movement.

Deviant models also involve a difference between the real velocity of an object, v_R, relative to an observer *O*, and its velocity *v* relative to *O* measured under the assumption that the one-way speed of light is uniformly *c*. As Winnie (1970: 84–86) shows, the relation between these magnitudes will be

$$(4) \qquad v_R = v \cdot \text{fudge factor}$$

, where the fudge factor is the same as in (3).

The reason why the real velocity relative to *O* will be different from the velocity measured under the standard assumption is that we can only measure velocities by sending and receiving signals that indicate locomotion. Consider two ways that an observer *O* can measure the speed of an object.

If *O* sets her clock to 0 when an object *X* passes her, and then she notes that at *T*, a signal was received from *X* indicating that *X* was at a distance of *n* meters, then *O* can only use these data to determine *X*'s relative speed if she knows how long it took the signal from *X* to reach her. The value that *O* calculates for *X*'s speed will be different under different assumptions about the one-way speed of light.

Alternatively, if *O* tries to measure the relative speed of *X* by attaching a speedometer to *X*, then the speed of *X* will be measured by a moving clock, and in order to get the speed of *X* relative to *O*'s frame from the speedometer reading on *X*, *O* will have to relate the readings on the moving clock to the readings on her own stationary clock. And we know from (3) that moving clocks will be asynchronous in a slightly different way in deviant models than in the standard one. Consequently, relative speeds will also be different in deviant models than in the standard one, because the time on moving clocks will change in a slightly different way.

Now suppose that we live in a deviant world where the speed of light is not uniform but we are assuming that it is. We synchronize two clocks, *A* and *B* locally at *P*, and then we transport *B* to 1 distance unit away at what we take to be velocity *v*. We assume that the time on *A*, t_A, will equal 1 / *v* seconds when *B* reaches its destination. We assume uniform one-way speed for light, so we use the standard time dilation formula (1), $t_A \cdot \sqrt{1 - v^2/c^2}$, to re-synchronize clock *B* after it arrives at its remote location.

Let's see what happens in reality. In reality, the velocity of *B* is different than we think it is. Its real speed, v_R, is given by (4). Since the real speed of *B* is v_R, clock *B* reaches its destination not when clock *A* reads $1 / v$ (as we think) but when clock *A* reads $1 / v_R$, which is a different number than $1 / v$. Let's distinguish these two values:

(5) $t_A^O = \dfrac{1}{v}$ (the real time on clock *A* when *B* arrives at its remote location)

(6) $t_A^R = \dfrac{1}{v_R}$ (what the observer thinks the time on clock *A* is when *B* arrives at its remote location)

We also know from (3) that in reality, the slowdown on *B* will be different than in the standard case. The readout on clock *B* upon arrival will be

(7)
$$
\begin{aligned}
t_B^R &= t_A^R \cdot \sqrt{1 - v^2/c^2} \cdot \text{fudge factor} = && \text{from (2)}\\
&= \frac{1}{v_R} \cdot \sqrt{1 - v^2/c^2} \cdot \text{fudge factor} = && \text{from (6)}\\
&= \frac{1}{v \cdot \text{fudge factor}} \cdot \sqrt{1 - v^2/c^2} \cdot \text{fudge factor} = && \text{from (4)}\\
&= \frac{1}{v} \cdot \sqrt{1 - v^2/c^2} = \\
&= t_A^O \cdot \sqrt{1 - v^2/c^2} && \text{from (5)}
\end{aligned}
$$

It follows that the way clock *B* becomes asynchronous in deviant scenarios will not tell the observers that the assumption of uniform velocity is wrong.

Suppose that we re-synchronize *B* with *A* after *B* has arrived at its remote location. We do this by setting *B* to t_A^O immediately after arrival, since we think that clock *A* reads t_A^O at that moment. In reality, *A* reads t_A^R at the moment in question, so *B* will run late or early compared to *A*, by the following amount:

(8)
$$
t_A^0 - t_A^R = \frac{1}{v} - \frac{1}{v_R} = \frac{1}{v} - \frac{1}{v \cdot \text{fudge factor}} =
$$
$$
= \frac{1}{v} - \frac{1}{v}\,\frac{c + v(2\varepsilon - 1)}{c} = \frac{2\varepsilon - 1}{c}
$$

As indicated under (2), 2ε is the ratio between the average round-trip speed of light, *c*, and its real speed in the direction in which *B* was transported. It follows that in reality, light beams travel at a speed of c / 2ε from *A* to *B*. Since *B* is at unit distance from *A*, it takes light 2ε / c seconds to go from *A* to *B*.

Suppose that, once we re-synchronized *B* with *A*, a light beam is emitted from *A* at $t_A = 0$. We know from (8) that when this happens, *B* reads (1 – 2ε) / c. It takes light 2ε / c seconds to go from *A* to *B*, so the readout on *B* at the moment of the light beam's arrival will be

$$(9) \qquad \frac{1 - 2\varepsilon}{c} + \frac{2\varepsilon}{c} = \frac{1}{c}$$

It follows that the readout on *B* will confirm the erroneous hypothesis that the one-way speed is *c*. Consequently, locally synchronizing and transporting clocks cannot help us measure the one-way speed of light.

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Long contents

This dissertation contains no material accepted for any other degrees in any other institutions. Neither does it contain material written and/or published by another person, except where noted in the form of bibliographical references.

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1 March 2015