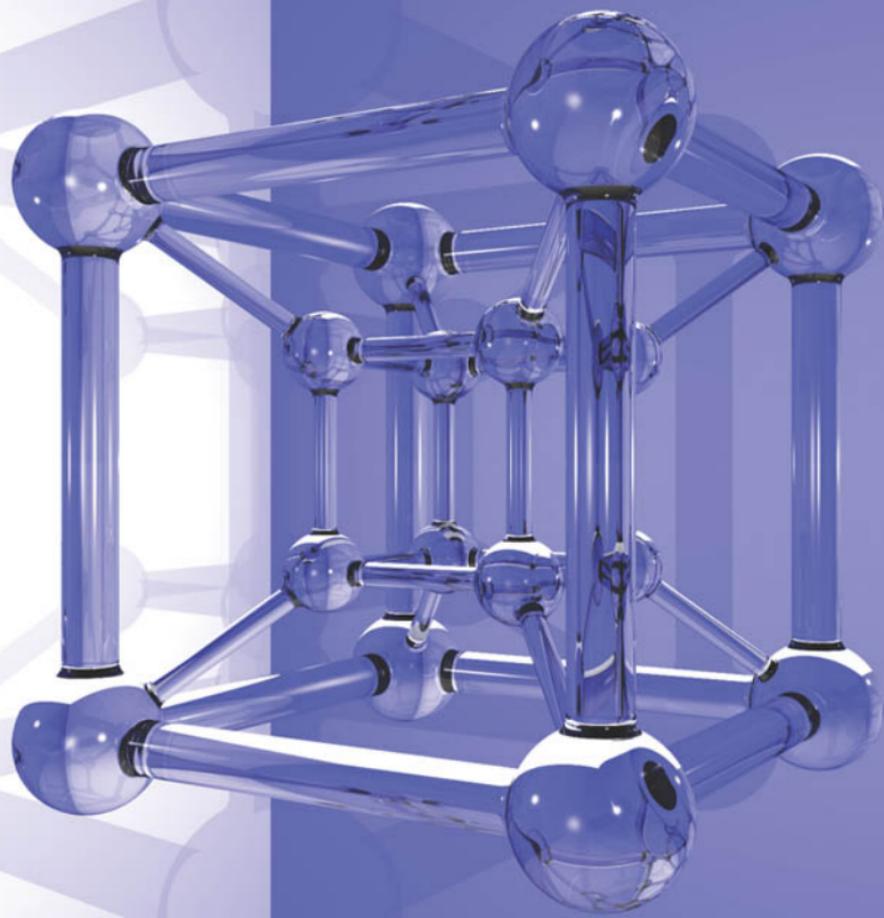


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The Metaphysics of Hyperspace

Hud Hudson



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HUD HUDSON

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For Aris and Eli

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Introduction

Modus ponens and *modus tollens* can wait. The most delightful exercises in the metaphysics of material objects involve formulating and arguing for the conditionals.

I would like to begin this book on selected topics in the metaphysics of material objects by saying a bit about my starting assumptions—both to alert the reader to potential points of disagreement at the very outset of my investigations and to state and motivate a handful of positions and principles that I shall employ without defense throughout the body of the work. Although I heartily endorse the starting assumptions in question, and whereas I will cheerfully opt for *modus ponens* when the time arrives, the final results I aim for here are largely conditional—i.e., if we accept foundations of such and such a kind, then we ought also to endorse such and such a philosophical view.

On classical logic and neighboring matters

In what I take to be a rather unfortunate trend, philosophers have been increasingly willing to deviate from standard or classical logic on what seem to me insufficiently motivated grounds. I do not believe that pressures arising from puzzles about composition or from vagueness or from semantic paradoxes—to take three rather prominent examples—should lead us to revise our accounts of, say, the nonvagueness of identity or of existential generalization or (heaven forbid) of the law of noncontradiction.¹ Moreover, whereas I understand sortal or relative identity claims of the form ‘*x* is the same *F* as *y*’, I also understand (and insist on the intelligibility of) classical or absolute identity claims of the

¹ For examples of such deviations see van Inwagen 1990*b*, Lewis 1986, and Priest 1995, respectively.

form ' $x = y$ ', and I take set membership to be all or nothing, never a matter of degree (when the degree is distinct from 0 or 1, that is).² Finally, I will work on the assumption that there is no ambiguity of meaning in the existential and universal quantifiers; apparent differences in meaning of quantificational expressions are to be explained away in terms of contextual restrictions.³

On material objects

I advocate realism about both abstract and concrete objects of many different, controversial sorts. Admittedly, as has been clearly (and amusingly) demonstrated, the distinction between the abstract and the concrete is not really all that clear;⁴ yet among what is commonly found under the heading 'abstracta' I recognize numbers, functions, sets, classes, propositions, properties, relations, and states of affairs, while under the heading 'concreta' I countenance spacetime, material substances, events, holes, and (at least one) immaterial substance. I will unabashedly invoke some of these abstract objects from time to time, without defending my right to call upon them and without troubling over whether some nominalist alternative would suffice. Less brazenly, I will not merely assume but rather will argue for certain positions regarding spacetime, events, holes, and immaterial substances in the chapters to follow. But at the moment I simply wish to register that I endorse a thesis we may call the "occupancy account of material objects", according to which 'material object' is analyzed as 'an object each of whose parts occupies a region of spacetime'. Unlike Descartes, I do not prefer 'is extended in' to 'occupies', for I think that this would mischaracterize point-sized objects as nonmaterial.⁵ Unlike Markosian (2000*b*), I do not prefer 'is located in' to 'occupies', for although this would correctly judge point-sized things as material, I think it would

² For recent challenges to these two theses see van Inwagen 1995*b* and 1990*b*, respectively.

³ See the introduction to Sider 2001 for an intriguing discussion of this issue.

⁴ See in particular David Lewis's five different ways of drawing the distinction, in Lewis 1986, esp. sect. 1.7, "Concreteness". (Lewis comments at length on four of the ways, briefly mentioning the fifth in a footnote.) For a very clear introduction to the difficulties in drawing a distinction, see Burgess and Rosen 1987, esp. 13–25.

⁵ See Part I, art. 53, of Descartes 1985: 210–11.

misclassify regions themselves as material. Finally, I would like to note that one of the primary reasons why I take a special interest in material objects is that I believe you and I are among their number.⁶

On substantivalism

The occupancy account of material objects has its commitments, though. Putting the weight of the analysis on ‘occupation’ rather than ‘extension’ or ‘location’ and acknowledging the primitive relation ‘present at’ that holds between regions and their inhabitants seems to require substantivalism about regions. Owing perhaps to a confusion of relationism with relativity, the question “substantivalism or relationism?” is often thought to have been decisively put to rest and filed away in the history of ideas—the outdated literature it sparked serviceable now primarily as a lesson on the human foibles of great figures like Leibniz and Newton. On the contrary, however, substantivalism and relationism are at the heart of an exciting and challenging series of current debates in the philosophy of space and time.⁷ Adopting substantivalism is hardly akin to, say, returning to the Ptolemaic theory of the heavens; but it is hardly uncontroversial, either. Potentially even more troublesome is that the occupancy account of material objects (combined with the thesis that, unlike identity, exact occupation can be a one–many relation) seems to forbid a maneuver attractive to some substantivalists of advocating a reductive analysis of material objects which identifies them with subregions of spacetime.⁸ Fortunately, I take both of these resulting commitments to be well motivated on independent grounds; so they do not strike me as drawbacks or embarrassments. Thus (although I shall have something critical to say against one standard argument for substantivalism in Chapter 1) I am thoroughly content to take substantivalism and a nonreductive theory of material objects as a point of departure.

⁶ See my 2001*a*, which contains a sustained investigation into just which items in our ontology it is best to identify with human persons, as well as a number of discussions and defenses of most of the starting points which I will put forth in this Introduction.

⁷ For an introduction and contribution to these debates see Earman 1989.

⁸ For one who advocates the reductive analysis as the best move for the substantivalist, see Sider 2001: 110 ff.

On relations to regions

I am a material object located in a manifold. Among regions, there is at least one that I occupy, some that I dominate, more that I causally influence, and others that I non-causally influence.⁹

Regions are monogamous. Despite popular support to the contrary, I believe that exact co-location of distinct material objects is metaphysically impossible.¹⁰ I don't mean to rule out the co-location of a material object with the region of space it occupies, or with an event occurring where it is located, or with a hole it fills, but rather to ban the co-location of distinct material substances. Constitution theorists disagree. Constitution theory arises largely out of the need to respond to a number of dazzling mereological puzzles. In addition to the relation of identity, such a theorist claims to find a constitution relation that holds at a time between two spatially co-located objects (or between a thing and some stuff). This is a relation, for example, allegedly holding between different chunks of steel and the sword they successively constitute. The idea is that although the weapon may be damaged when the battle is won and have less steel than it did when first unsheathed, one and the same sword is now constituted by a piece of steel which once was a mere proper part of the steel originally serving that purpose.¹¹ Constitution theorists may then offer solutions to outstanding puzzles involving simples, composites, persistence, and change.¹² I reject these solutions in favor of the competing solutions offered by a combination of four-dimensionalism and counterpart theory, but I will not argue for their superiority here.¹³ Moreover, in rejecting co-location as a starting

⁹ Elsewhere I have defended the view that I actually occupy multiple (overlapping) regions of spacetime, on the grounds that this is required by the best solution to the so-called Problem of the Many; see my 2001*a*: ch. 2. Here, however, I insist only on at least one.

¹⁰ Sider (2000) has taken Zimmerman (1996*b*) to task for a similar view, according to which it is an essential feature of material objects not to share their locations. But I do not take the metaphysical ban on co-location to be analytic, and thus I do not think that Sider's critique hits its mark.

¹¹ For a book-length treatment of constitution theory with an application to human persons, see Baker 2000 together with the review offered in Sider 2002. For a slightly different approach, see Corcoran 1998 and 1999.

¹² For an excellent introduction to the puzzles in question and the variety of solutions on offer, see Sider 2001.

¹³ For arguments see my 2001*a*: ch. 2 and Sider 2001.

point, I ignore not only the constitution theorists but also those who think there could be noninteracting material objects that pass right through one another and that do not share parts at the times they share locations. Exact occupation, then, may function as an identity principle among material substances: if x exactly occupies the same region as y , then $x = y$.

When I dominate a region, other material things are excluded from it, either because regions are monogamous and my parts are already to be found there or because my parts manifest repulsive forces which prevent any material thing from intruding. This is not just a way of repeating the ban on co-location. Rather, the contingent laws of our world prevent a certain kind of proximity between material objects that might well be overcome in worlds with different laws governing repulsion and attraction. Accordingly, I dominate regions that are somewhat larger than the regions I occupy. Finally, when I causally influence a region, events taking place in my parts are causes of events taking place in the region in question. I can, of course, causally influence regions that I neither occupy nor dominate.

On composition and decomposition

Inquiries into the conditions under which a plurality of objects has a sum have been among the highlights of recent analytic metaphysics.¹⁴ In this work I will assume the truth of universalism (or a principle of unrestricted mereological conjunctivism).

(Universalism): Necessarily, for any objects, the x s, there exists an object, y , such that the x s compose y .¹⁵

According to this very liberal theory of composition, whenever there are some things, those things have a mereological fusion no matter what spatio-temporal and causal relations they may or may not satisfy. Moreover, to call attention to this fusion is to call attention to an additional piece of the world's furniture and is not to be confused with talking about the objects collectively, or about a property they share, or about the set

¹⁴ Much of it sparked by Peter van Inwagen's superb 1990*b*.

¹⁵ For defenses of universalism, see David Lewis's argument from vagueness (Lewis 1986: 211–13), Michael Rea's argument from functionality (Rea 1998a), and my 2001*a*: ch. 3. For a widely discussed attack on universalism, see van Inwagen 1990*b*: 72–80.

that has them as members. Finally, parthood is here treated as a two-place relation with no mandatory indexing to times.

Inquiries into the conditions under which a given object has a plurality of parts and into modes of decomposition have not enjoyed the prominence of debates about principles on composition, but the tide is turning.¹⁶ Whereas universalism assures us that many will yield one, the doctrine of arbitrary undetached parts (DAUP) (together with a sufficiently liberal view of which regions are receptacles) assures us that (an extended) one will yield many; that is to say, whereas universalism provides a liberal theory of composition, DAUP provides a liberal theory of decomposition.

(DAUP): Necessarily, for any material object, x , and regions, s and s^* , if s is the region x exactly occupies, and if s^* is an exactly occupiable subregion of s , then there exists a material object, y , such that (i) y exactly occupies s^* , and (ii) y is a part of x .

According to this very liberal theory of decomposition, whenever there is an extended object, that object has parts entirely confined to each of the occupiable subregions of the region it occupies. Moreover, to call attention to these parts is to call attention to additional pieces of the world's furniture and is not to be confused with talking about portions of the object, or about conceptual parts, or about potential parts, or about what would exist if the rest of the object were cut away. Finally, as with parthood, occupation is here treated as a two-place relation with no mandatory indexing to times.¹⁷

On simples and gunk

Curiously, inquiries into the analysis of 'material simple' and 'material atomless gunk' have not been as widely pursued as have inquiries into the conditions under which composition occurs, and this despite the obvious significance of discovering whether there is a fundamental level of material partless things and what those things would be like.¹⁸

¹⁶ For early discussion see van Inwagen 1981 and Zimmerman 1996*a* and *b*.

¹⁷ Part of the justification for the absence of the familiar temporal indices in parthood and occupation is explained in the sections on persistence and change and on eternalism below.

¹⁸ Some exceptions include Markosian 1998 and Zimmerman 1996*a* and *b*. David Lewis introduced the term 'atomless gunk' into the literature in his 1991. For recent

I accept the phrase ‘a material object that has no proper parts’ as a proper definition of ‘material simple’, and I shall presuppose the following topologically based analysis of ‘material simple’ that I call the “pointy view”:

(PV): Necessarily, x is a material simple if and only if x exactly occupies a point-sized region.

I accept the phrase ‘a material object each of whose parts has proper parts’ as a proper definition of ‘material atomless gunk’, and I take such objects to be impossible. I have offered sustained arguments for this conclusion and a discussion of its significance elsewhere, and so in the present work I shall take those arguments as read and write under the hazardous assumption that they are successful.¹⁹

On persistence and change

I subscribe to the thesis of four-dimensionalism. At the most general level, four-dimensionalism is a theory about objects and their parts. The principal idea is that necessarily, for each way of exhaustively dividing the lifetime of any object, x , into two parts, there is a corresponding way of dividing x itself into two parts, each of which is present throughout, but not outside, the corresponding part of x 's lifetime. Or, if we let ‘TS(x)’ be the set of times at which x is present, we may say more formally:

(4D): Necessarily, for any object, x , and for any non-empty, non-overlapping sets of times, t_1 and t_2 whose union is TS(x), there are two objects, x_1 and x_2 , such that (i) x is the fusion of x_1 and x_2 ; and (ii) TS(x_1) = t_1 , whereas the TS(x_2) = t_2 .²⁰

It is worth noting that the general thesis of four-dimensionalism is here stated in very strong language, insofar as (i) it is formulated as a

excellent work on this theme, see the collection of papers on simples and atomless gunk in *The Monist*, 87, no. 3 (2004).

¹⁹ See my 2001*a*: ch. 3 for a discussion of the pointy view and for a series of arguments against the possibility of material atomless gunk.

²⁰ More carefully, I subscribe to an unorthodox relative of four-dimensionalism: viz., partism. Partism is introduced, motivated, and defended in my 2001*a* ch. 2. I am happy, however, to work with its less complicated and more widely known cousin. In stating what I call (4D), (TP), (4DP), and in the informal gloss on (4D), I directly borrow formulations from Sider's excellent 1997.

necessary truth, (ii) it allows for the existence of instantaneous objects, and (iii) it permits very odd fusions indeed, including such items as the thing which is the fusion of two instantaneous objects which are a year apart. Although some four-dimensionalists would regard these items as negotiable, in the following discussion I shall nevertheless presuppose the strong version of the doctrine stated in (4D).

Since those who subscribe to (4D) often speak of the various parts into which x may be divided as x 's temporal parts, we have a definition: (TP): x is an instantaneous temporal part of y at instant $t =_{df}$ (i) x is a part of y ; (ii) x is present at, but only at, t ; and (iii) x overlaps every part of y that is present at t .

The four-dimensionalist may thus speak either of the instantaneous temporal parts of an object, x , or of the extended temporal parts of x , where the latter are regarded as fusions of x 's instantaneous temporal parts. The application of (4D) and the notion of temporal parts to an analysis of persistence over time now may be stated as follows:

(4DP): Necessarily, an object, x , persists through (is present at every member of) some temporal interval, T , if and only if for every instant t in T , x has an instantaneous temporal part at t .

Such is the skeletal reconstruction of the four-dimensionalist's views on parthood and persistence. The thesis of four-dimensionalism has been center stage in some of the most rich and exciting contributions to the metaphysics literature over the last couple of decades. Prominent defenses of four-dimensionalism arise from exploiting analogies between space and time (Taylor 1992), from the theory of special relativity (Balashov 1999, 2000; Quine 1960), from a denial of presentism and an affirmation of eternalism,²¹ from the problem of temporary intrinsics (Lewis 1986), from considerations of Humean supervenience (Lewis 1983), as an answer to puzzles of material constitution (Heller 1990, Sider 2001), and most recently from challenging reflections on vagueness and composition (Sider 2001). Attacks on four-dimensionalism come from all sides, but perhaps the most influential are those that maintain that four-dimensionalism is unintelligible,²² those that main-

²¹ Merricks 1995 contains a discussion of this argument, but Merricks is himself a three-dimensionalist.

²² This criticism, though, is laid to rest with Sider 1997, in which four-dimensionalism is stated using only logical, temporal, and mereological vocabulary.

tain that four-dimensionalism is unmotivated (Rea 1998*b*), and those that present modal arguments designed to show that (to his discredit) the four-dimensionalist must consort with the counterpart theorist.²³

Change across time for the four-dimensionalist, then, is a matter of different temporal parts of one and the same object manifesting different properties. Moreover (given the combination of four-dimensionalism and the arbitrary cross-temporal fusions licensed by universalism), temporal predication is not at all a straightforward affair. First some terminology.²⁴

(MF): x is a maximal $F =_{df}$ x is an F , and x is not a proper, temporal part of any F

(TF): x is a temporary $F =_{df}$ x has some maximal F as a proper, temporal part.

(FP): x is an F -part $=_{df}$ x is a proper, temporal part of some maximal F

Notice that for any object, x , and value, F , x can satisfy (at most) one of the three definitions above. Accordingly, a proposition of the form ' x is an F at t ' leaves open important questions for the four-dimensionalist universalist. In particular, it leaves open the question of whether or not x is an F at all. First, a four-dimensionalist is willing to say of some x which is a maximal F that ' x is an F at t ', and mean by that phrase that the temporally extended thing which is x has a part that is present at t that is an F . Of course, he need not restrict such parts to instantaneous, temporal parts. In cases where F is something such as 'eighty-year continuant', it may very well be the improper part of x which is present at t that has the feature in question. Similarly, the four-dimensionalist is equally willing to say of some x which is a temporary F that ' x is an F at t ', so long as we interpret this phrase as attributing F to some four-dimensional being other than x who happens to stage-share with x at t . Consequently, since ' x is an F at t ' is neutral with respect to x 's being either a maximal F or a temporary F or an F -part, and since the first of these options entails that ' x is an F ', and since the second is inconsistent with x 's being an F , the phrase ' x is an F at t ' is neutral with respect to whether or not x is an F *simpliciter*.

²³ For the accusation see van Inwagen 1990*a*; for replies see Heller 1993 and Sider 2001.

²⁴ This brief discussion is taken from my 2001*a*: ch. 4, which explores the issue of temporal predication for the four-dimensionalist universalist at some length.

On eternalism

Consider first those objects that are present, then those that are actual, and finally those that simply are or have being. Of course, you might think that these are three ways of getting at the same plurality; but if so, you will be challenged on this score: first by the eternalists, who hold (against the presentists) that there exist some objects that are not present; second by the possibilists, who hold (against the actualists) that there exist some objects that are not actual; third by the Meinongians, who hold (against the sensible) that there are some objects that have being but not existence.²⁵ I am a non-Meinongian eternalist who can't make up his mind about the possibilism/actualism dispute. Accordingly, I take ontological claims about what there is to be insensitive to the alleged having being/existence distinction and as not being bound by the requirement that coexisting things be co-present.

On modality and recombination

The epistemology of the merely possible—i.e., the truth conditions for and justification of those claims about what is possibly (but for all we know not actually) the case—is a delicate affair. Some philosophers soberly advocate a rather austere modal skepticism, but few heed this advice.²⁶ Others accept extremely liberal recombination principles according to which, for example, any pattern of instantiation of a genuine relation is possible—*any* pattern (Sider, unpublished). Theists (or anyone else who thinks that there is a necessarily existing something or other whose nature rules out certain—perhaps gratuitously evil—patterns of instantiation of genuine relations) might wish to insist on a qualification here and there. For the most part, I'm with the liberals. As it turns out, my own use of the recombination principle manages to generate only pretty unremarkable material objects, notable primarily for their topological features.

²⁵ For a defense of presentism see Markosian 2004*a*, and for a critique see Sider 2001: ch. 2. For more on the threefold distinction above and its relation to the slogan “to be real is to have causal powers” see my 2003*a*.

²⁶ For an instance of the advice, see van Inwagen 2001. For instances of those who don't follow it, pick up almost any issue of any contemporary journal in the analytic tradition.

Much more controversially, I favor a counterpart-theoretic account of *de re* modal predication. Accordingly, I take *de re* modal claims of the form ‘*x* could have been *F*’ to be made true by an object which is *F* and which bears the relevant counterpart relation to *x*, where relevance is contextually determined. The virtues and vices of counterpart theory are well known and widely discussed, and given how very little weight I will put on the view in the following chapters, I will here pass over the debate with no more than a note (see Lewis 1986, Hazen 1979, and Plantinga 1974).

On vagueness

Few things in metaphysics strike me as obvious, but a notable exception is the thesis that ontological vagueness is metaphysically impossible; that is to say, there is no such thing as non-epistemic, non-linguistic indeterminateness with respect to existence or identity. Others are willing to be even more severe in their criticism, by maintaining that ontological vagueness is also unintelligible (Lewis 1986). But that seems like overkill. It’s not that I fail to understand the ontologically vague reading of ‘it is indeterminate whether *x* at *t* is identical to *y* at *t**’. Instead, it’s that I fail to see how it is possible that the indeterminacy in question could be anything other than epistemic or buried in some vague, singular, referring expression substituted for ‘*x*’, ‘*y*’, ‘*t*’, or ‘*t**’.²⁷

Instead, all vagueness is epistemic. Or so says the epistemicist, with whom I side. Epistemicism may be characterized as a dual thesis: (i) A proposition expressed by a vague sentence in a borderline case is either true or false, and (ii) we are inescapably ignorant of the correct truth-value (or if we do come to know, it’s because angels inform us or some such thing).²⁸ Accordingly, given a standard sorites series, there will be a single centimeter that will make the difference between being non-tall and tall, and there will be a single pebble that will turn a non-heap into a

²⁷ van Inwagen 1990*b* reluctantly champions ontological vagueness, but he need not do so if epistemicism is true. Also see Heller 1996 for an intriguing argument against ontological vagueness. I show how van Inwagen can avoid this alleged consequence of his view on composition, and I supply an additional defense of Heller’s primary argument, in my 2001*a*: ch. 3.

²⁸ In addition to his 1994 book-length treatment and defense of epistemicism, see Williamson’s superb series of essays, 1997*a*, 1997*b*, 1997*c*, 1997*d*, 1996*a*, 1996*b*, and 1995. His 1997*b* provides a brief (but very clear) introduction to the issues.

heap. Better yet, some trillionth of a centimeter and some trillionth of a pebble will do the trick equally well. This is not to say, though, that there must be a last amount which counts as non-tall, any more than there must be a last real number less than 1, but any sorites series which increases in finite increments (however small) will be subject to a sharp cut-off. Accordingly, for any vague term, *F*, an *F* can be arbitrarily close to a *non-F*.

Epistemicism's opponents are quick to balk at the implausibility of our terms having such fine-grained precision when they seem to arise from a pattern of use and dispositions that simply could not generate anything as exacting as required. I take these to be significant objections and something of an embarrassment for the epistemicist to explain away. But I think they have (for the most part) been successfully answered,²⁹ and in the mystery that is the current vagueness literature, I think epistemicism can claim considerable advantage over its primary rivals. In short, I think that the seeming hopelessness of this theory is merely apparent, while its apparent advantages are genuine. Epistemicism permits us to retain both classical logic and a disquotational principle in our theory of truth, whereas its rivals offer either many truth-values subject to the same allegedly objectionable sharp cut-offs that threaten epistemicism or else a theory of truth on which disquotation fails. Epistemicism delivers a decisive and beautiful resolution to the problem of higher-order vagueness, whereas its rivals either wholly fail to address the problem or disguise it with empty promises of an infinite hierarchy of vague meta-logics. And finally, the costs of epistemicism are mediated by the fact that the ignorance which is postulated by the theory is motivated also by independent epistemological reflections. I shall proceed on the assumption that epistemicism is true.³⁰

On bruteness

By 'brute fact' I shall mean a contingently true proposition without any sufficient reason (i.e., a contingent truth without any explanation for its

²⁹ For responses to this charge, see Williamson 1994: chs. 7 and 8, as well as Sorensen 2001 and 1996.

³⁰ I have contributed to the defense of epistemicism largely by way of furthering objections against both ontological vagueness and the method of supervaluations, in my 2001*a*: ch. 3 (from which I have also adapted this paragraph).

truth, a truth that is not true *in virtue of* anything). The principle of sufficient reason is forever forfeit and, like it or not, we have to live with bruteness somewhere.³¹ It can generate something of an intellectual crisis for those of us with a rationalist turn of mind to have to confront the fact that some contingent truths just are true, and that's all the explanation we get. Of course, not every fact is brute, and thus we might feel pressure to look for a principled way of dividing brute facts from nonbrute ones. It is one of the scandals of contemporary philosophy that so little work has been done on this important topic, and sadly I have no well worked-out recommendation in this area. I do, however, have a strong aversion to opting for bruteness in many of the debates that will surface in the course of this work, and where I can, I will follow the methodological advice to let a wide variety of other theoretical considerations trump an appeal to bruteness when seeking a solution.

A promising note directed to those who are as deeply disappointed as I was at having some bruteness or other thrust upon them: I have discovered that this distress can be partially compensated for if one is—as I am—a theist cheered by the prospect of a new argument for the existence of God that proceeds by resurrecting a close cousin of the principle of sufficient reason while rooting all bruteness in agency. . . but that is a story for another occasion.

On intuitions

Throughout the text I will appeal to my intuitions on some metaphysical thesis or other, and I will invite the reader to reflect on whether she shares these intuitions. I don't really care for the term 'intuition', but it is entrenched, and I see no real advantage to coining a new one. When it comes to a theory of justification, I am an evidentialist, and I take my intuitions on metaphysical matters (including modal matters) to be evidence—not trump cards, not conclusive, knock-down, drag-out arguments, but evidence (see Feldman and Conee 2004). So does everyone else (or so it seems to me), and despite the occasional rolling

³¹ The costs of regaining the principle of sufficient reason are either necessitarianism (the thesis that all truths are metaphysically necessary truths) or Lewisian modal metaphysics, neither of which seems particularly attractive. See why, and some of what is involved in paying these costs, in my 1999 and 1997. By endorsing some brute facts, however, I do not mean to give up on the view that truth supervenes on being.

of eyes at the confession of an intuition, there is nothing shameful about this. Really—what else are we supposed to appeal to? Of course, there is no shortage of conflicts of intuition between equally talented and equally well-informed philosophers, and there are those quick to cite this phenomenon in defense of the allegedly philosophically cautious policy of denying evidential value to such intuitions. In response, I would like to quote van Inwagen on a somewhat related theme that appears to me to express exactly the right attitude in its original context as well as in the present one:

How can it be that equally intelligent and well-trained philosophers can disagree about the freedom of the will or nominalism or the covering-law model of scientific explanation when each is aware of all of the arguments and distinctions and other relevant considerations that the others are aware of? How . . . can we philosophers possibly regard ourselves as justified in believing much of anything of philosophical significance in this embarrassing circumstance? . . . Well, I do believe [some of] these things. And I believe that I am justified in believing them. And I am confident that I am right. But how can I take these positions? I don't know. That is itself a philosophical question, and I have no firm opinion about its correct answer. I suppose my best guess is that I enjoy some sort of philosophical insight . . . that, for all [their] merits, is somehow denied to [others] . . . but maybe my best guess is wrong. I'm confident about only one thing in this area: the question must have some good answer. For not only do my beliefs about these questions seem to me to be undeniably true, but (quite independently of any consideration of which theses it is that seem to me to be true), I don't want to be forced into a position in which I can't see my way clear to accepting any philosophical thesis of any consequence. Let us call this unattractive position philosophical skepticism. (Note that I am not using this phrase in its usual sense of "comprehensive and general skepticism based on philosophical argument." Note also that philosophical skepticism is not a thesis—if it were, it's hard to see how it could be accepted without pragmatic contradiction—but a state: philosophical skeptics are people who can't see their way clear to being nominalists or realists, dualists or monists, ordinary-language philosophers or phenomenologists; people, in short, who are aware of many philosophical options but take none of them, people who have listened to many philosophical debates but have never once declared a winner.) I think that any philosopher who does not wish to be a philosophical skeptic—I know of no philosopher who is a philosophical skeptic—must agree with me that this question has some good answer: whatever the reason, it must be possible for one to be justified in accepting a philosophical thesis when there are philosophers who, by all objective and external criteria, are

at least equally well qualified to pronounce on that thesis and who reject it. (van Inwagen 1996: 138–9)

Once again, then, in the interests of avoiding the rather unattractive philosophical skepticism just described (and of avoiding what has been called ‘an epistemically self-defeating position’), I will freely and without apology appeal to my intuitions about possibility and plausibility, consequences and counterexamples, when choosing among metaphysical theses.³²

On theism

I am a theist—and to be more specific—a Christian theist. I have learned, however, that discovering this bit of biographical information about an author often serves as a red flag for a fair portion of his intended audience, who (unsympathetic to the religious views but familiar with a number of their adherents) suspect that when the chips are down and the argument is on the line, some religiously based principle or other will be called in to do work better done by proper (i.e., nontheistic) analytic metaphysics. Accordingly, many potential readers are somewhat inclined to stave off disappointment and not pick up the work of such a person in the first place. Presumably the complaint is not simply that the theist believes that her theism can play a role in her general metaphysics (for it is boringly obvious that one’s beliefs about what there is should play a role in one’s general metaphysics). Rather, the worry must be that this particular belief about what there is fails to be justified or plausible or intelligible or whatever—and in fact so much so as to infect whatever discussions it intrudes on with the same feature. Unfortunately (with the exception of Chapters 7 and 8, which are explicitly devoted to questions concerning theism and Christianity, and some incidental comments about modal recombination principles and bruteness), I simply can’t find much of anything for my theism to contribute to in the arguments of this book. Thus, whereas I disagree with the pessimistic view of the defensibility of

³² Compare George Bealer, who has defended what he calls “the self-defeat argument” for the conclusion that “whoever engages in epistemic appraisal of their beliefs and theories will end up in an epistemically self-defeating position unless they accept intuitions as evidence”. See Bealer 1999: 34.

religious views playing a role in analytic metaphysics, there will be no occasion to take sides on this question for much of the discussion that follows and likewise no reason (at least of this kind) for the confident atheist to put the book down before its final two chapters.

On hyperspace and topology

Although this book is a collection of largely independent essays on some of the outstanding issues in the metaphysics of material objects, two unifying (but somewhat technical) threads running through much of the manuscript are the notion of a four-dimensional (or higher) space and the topological notions of open, closed, and partially open objects.

The starting point for the relevant mathematics takes as its model the familiar coordinate representation of two-dimensional Euclidean space or three-dimensional Euclidean space and expresses an n -dimensional Euclidean space as the set of all n -tuples $(x_1, x_2, x_3, \dots, x_n)$ of real numbers. The thesis that there could be such a space is logically consistent. Of course, logical consistency doesn't guarantee that the four-space of the mathematicians has any interesting relation to the physical space in which we live and breathe. Worse still, logical consistency doesn't even guarantee the bare metaphysical possibility of a four-space world. But it does block at least one type of objection to discussing the potential metaphysical implications of this kind of hyperspace or of its non-Euclidean cousins. Armed with such a minimal cloak of protection, I will occasionally venture into discussions of the possibility and actuality of hyperspace and of its significance. Happily, much of what I have to say on these topics can be said and appreciated (or perhaps refuted) with a minimum of technical jargon in the presentation (or rejoinders). Accordingly, I hope to remain as informal as I can and to avoid any serious digression into the underlying mathematics. If I can stay free of mathematical error in informal presentation, I will be content to make informal contributions to the relevant philosophical discussions.

With respect to the topology, however, permit me to rehearse briefly a handful of definitions that will provide a basic vocabulary that should help us frame several of the debates to come in a very precise manner.³³

³³ The following definitions are borrowed from Cartwright 1987. Note that I have rewritten the *definiens* of (D3) so as to avoid an ambiguity in the original, and

- (D1) R is connected $=_{df}$ R is not disconnected.
- (D2) R is disconnected $=_{df}$ R is the union of two non-null separated regions.
- (D3) R and R' are separated $=_{df}$ (i) the intersection of R with the closure of R' is null, and (ii) the intersection of R' with the closure of R is null.
- (D4) the closure of $R =_{df}$ the union of R with the set of all its boundary points.
- (D5) p is a boundary point of $R =_{df}$ every open area about p has a non-null intersection with both R and the complement of R .
- (D6) R is an open area about $p =_{df}$ the members of R are all and only those points that are less than some fixed distance from p .
- (D7) the complement of $R =_{df}$ the set of points in space not in R .
- (D8) x is an open object [region] $=_{df}$ x exactly occupies [is] a region that has none of its boundary points as members.
- (D9) x is a closed object [region] $=_{df}$ x exactly occupies [is] a region that has all of its boundary points as members.
- (D10) x is a partially open object [region] $=_{df}$ x exactly occupies [is] a region that has some but not all of its boundary points as members.

It is worth noting that these definitions characterize regions as sets of points. This is merely a heuristic device which I will invoke now and again. When being ontologically serious about regions, I prefer that they be identified either with pluralities of or with mereological fusions of concrete, unextended, simple points.

We really shouldn't require anything much more technical than the material that appears in this Introduction to engage in a rigorous and satisfying way some of the most delightful puzzles that the metaphysics of material objects has to offer. As "bookend-chapters" I will take up philosophical (as opposed to physics-based) reasons to believe in hyper-space, exploring some nontheistic reasons in Chapter 1, some theistic reasons in Chapter 7, and some distinctively Christian reasons in

I have substituted 'area' for 'sphere' in (D5) and (D6) so as not to appear to prejudge the number of dimensions in the neighborhood of some given point. Finally, owing to the non-topological notion of distance which appears in (D6), there is really no reason to insist on the "topological" nature of these semi-formal definitions.

Chapter 8. In the intervening chapters, I will inquire into a variety of puzzles in the metaphysics of material objects that are either (i) generated by the hypothesis of hyperspace (e.g., Chapter 6 on the amusing topics of mirror determinism and mirror incompatibilism) or else (ii) informed by the hypothesis of hyperspace (e.g., Chapters 2, 3, 4, and 5 on the topics of receptacles, boundaries, contact, occupation, and superluminal motion).

1

Concerning Some Philosophical Reasons to Believe in Hyperspace

§1 Two Voices from Königsberg

In 1919 an unknown mathematician and *Privatdozent* from Königsberg—Theodor Kaluza—wrote a letter to Einstein, presenting him with a paper purporting to unify Einstein’s theory of gravity with Maxwell’s electromagnetic theory. The crucial insight on which the unification turned involved positing an additional spatial dimension which afforded such elegance that it inspired its author to declare that his work possessed a “virtually unsurpassed formal unity... which could not amount to the mere alluring play of a capricious accident”. With Einstein’s encouragement and assistance the paper was published two years later (Kaluza 1921).

Although it briefly enjoyed the attention of the scientists of the day, Kaluza’s ideas (in their more developed and better known dress as the Kaluza–Klein theory) soon gave way to more attractive research opportunities offered by quantum mechanics. Half a century later, however, theories of higher dimensions had steadily worked their way back into the mainstream physics literature with the onset of intense and widespread study of so-called string theory—a curious mix of controversial physical hypotheses and mathematics that gave rise to a theory whose attractiveness consists in a combination of aesthetics and the promise of unification on an unprecedented scale. Currently, the landscape of the physics literature has been marked by an explosion of interest in multi-dimensional spaces, making it seem ever more likely that the next revolution in science may well be played out against the background of higher-dimensional geometry.¹

¹ For a popular and accessible account of these developments see Greene 2004 and 1999.

What Theodor Kaluza did for physics in introducing the relevance of higher-dimensional spaces into a new academic field, Immanuel Kant did for philosophy. In 1747, some 170 years before Kaluza's letter to Einstein, an unknown philosopher and tutor from Königsberg published his very first paper (containing an investigation of Cartesian and Leibnizian theories of physical forces) and speculated that

a science of [spaces of more than three dimensions] would undoubtedly be the highest enterprise which a finite understanding could undertake in the field of geometry. . . if it is possible that there are extensions with other dimensions, it is also very probable that God has somewhere brought them into being; for His works have all the magnitude and manifoldness of which they are capable. . . [such higher spaces would] not belong to our world, but must form separate worlds. (Kant 1747: 24–5)

Although he was writing in defense of a three-dimensional space, Kant here anticipates debates on the possibility of higher dimensions, on their plenitude, occupants, variability, and independence, on their inaccessibility, and on their relation to God's nature (or—stripped of theological overtones—on their role in cosmology). Now string theory has been spectacularly fruitful, and perhaps there is no reason to expect similar breathtaking consequences if we follow Kant and pair the hypothesis of hyperspace with philosophical puzzles rather than with those of physics; but perhaps a little optimism is justified.

But perhaps a bit of caution is in order, as well. The literary history of four-space is littered with silliness and sordid stories, such as that of the alleged psychic Henry Slade who in the 1870s caused quite a stir in London when he was put on trial for fraud. Claiming to have access to the fourth dimension and contact with the spirits residing there, he gained notoriety by performing a variety of tricks before willing and credulous audiences. That a con artist could put a sting on the gullible well-to-do is no surprise, but in an interesting twist his alleged feats received the heavy endorsement of several outstanding members of the scientific community.² As has been frequently remarked, this is perhaps no surprise either, since there is no reason to think that a community of

² See Rucker's delightfully entertaining 1984 for a brief overview of the highs (and lows) of this and related stories. Among other reported instances of alleged silliness one sometimes finds references to the late nineteenth-century works of Schofield (1888) and Willink (1893), who earned the unenviable reputation of being mystical cranks as a result of writing on higher dimensions with the aim of rescuing certain religious

scientists would be particularly good at spotting the tricks of a magician. The will to believe is strong, and when coupled with a hard-won and secret-society-like knowledge about how hyperspace could figure in an explanation of the illusions, a number of otherwise much more careful thinkers found themselves defending claims on the basis of evidence that they were fully able to see was inadequate. Philosophers are probably no better than physicists in resisting the seductive and exciting suggestion of the explanatory power afforded by introducing higher-dimensional spaces into their attempts to think through certain puzzles and problems. The danger here is not so much of being led astray by sleight of hand, but rather of taking the consistency and elegance of some hypothesis involving hyperspace to be good evidence of its truth.

Notwithstanding this cautionary tale, however, in this chapter I shall ask whether there are any philosophical (as opposed to physics-based) reasons to believe in hyperspace, and without any pretensions towards comprehensiveness in an answer, I would like to take up two different sorts of reasons about which I have something to say.

§2 Incongruent Counterparts and Hyperspace

In addition to his prescient remarks about hyperspace in his very early work on forces noted above, Kant was also the first to notice the philosophical significance of a remarkable phenomenon that immediately directs us to one of the most intriguing points of connection between higher-dimensional spaces and philosophy. Generations of thinkers who have followed have inherited this problem from Kant. Unfortunately (as was the case with Kant himself), whereas there seems to be a widespread and firm conviction that the existence of incongruent counterparts establishes something, there is just no single verdict about what.³

doctrines from ridicule. Alas, one person's silliness is another's deep and penetrating insight, and I will have something modest but supportive to say about these potential applications to religious doctrines in Chs. 7 and 8 below.

³ For a fascinating introduction to some of the candidate answers, see the outstanding collection of papers in this area (both historical and contemporary) in Van Cleve and Frederick 1991.

Almost everyone illustrates the phenomenon of incongruent counterparts with an example of right and left hands (no doubt to facilitate any hand-waving that may need to accompany the discussions so introduced). A perfectly representative introduction is put forth by James Van Cleve and Robert E. Frederick as they open the preface to their collection of papers on the philosophy of right and left with these words: “Incongruent counterparts are objects that are perfectly similar except for being mirror images of each other, such as left and right human hands . . . [Kant] called them ‘counterparts’ because they are similar in nearly every way, ‘incongruent’ because, despite their similarity, one could never be put in the place of the other” (1991: p. vii).

Before we proceed, permit me two critical remarks aimed at this rather popular manner of introduction. First, such loose talk of mirror images is as misleading as it is helpful. Neither hand is really a mirror image of anything, even though there are obvious similarities in your visual experiences when you observe your right palm facing a mirror and then when you observe your right palm facing your left palm. Perhaps the term ‘mirror hologram’ is something of an improvement, but I tend to think that such talk fosters the myth that mirrors reverse right/left, a topic confusing enough in itself to render allusions to mirror-anypthings a poor guide to making accessible some other puzzle.⁴ My other complaint against this manner of introducing the phenomenon is directed at the explanation of the choice of the label ‘incongruent’ — “‘incongruent’ because, despite their similarity, one could never be put in the place of the other”. The problem here is that such an overly restrictive characterization of the situation may seem to rule out what

⁴ On this point let me recommend Ned Block’s insightful article (1974) on the question “Why do mirrors reverse right/left and not up/down?” Depending on the interpretation of the question, the short and surprising answer is: “They don’t.” It has occurred to me, however, that owing to (contingent) cosmic speed limits, there is a sense in which mirrors do reverse past/future: “The way I recently was is the way he soon will be.”

One cautious remark: I say that “neither hand is really a mirror image of anything”, but this may be too hasty. Just as we might regard a temporal part of a two-dimensional subregion of a mirror’s surface as a genuine material object to be identified with the mirror image of a right hand, so too, we might regard a three-dimensional right hand as a genuine material object to be identified with the mirror image of some object in four-dimensional space. Essentially the same move is available, since three-dimensional objects are suited to be mirror images of four-dimensional creatures. I will return to this point in Ch. 6 below.

has come to be one of the most popular reactions to it: namely, that a right hand most certainly can be put in place of a left one, provided that it first takes a trip through a higher-dimensional space. The German astronomer and mathematician August Ferdinand Möbius (1827) was the first to suggest this point by providing what he described as an argument from analogy to a space of four dimensions. Möbius seemed a bit tentative, however, and to some extent undercut his own insight when he remarked that the relevant coincidence is impossible insofar as a space of four dimensions cannot be thought. The idea has received contemporary favor (and popularization) through the works of Martin Gardner (esp. his 1989). But although the possibility of four-dimensional space is currently taken seriously, not all commentators who are willing to countenance this possibility agree about what lessons it promises to teach regarding incongruent counterparts (see, e.g., Nerlich 1973).

It is commonplace to motivate this popular point about rotating the (so-called) incongruent counterparts through a higher space by appealing to the right/left phenomenon as it appears in two-dimensional space. For example, one might concentrate on the Flatland figures ‘p’ and ‘q’, which cannot be made to coincide when their movements are confined to the plane on which they normally reside, but which come to be recognized in Flatland as perfectly congruent after our ‘q’ flips into a ‘p’ by traveling through a third dimension of space.

Although it would prove just as useful in eliciting the relevant proposal about a right hand rotating through four-dimensional space, it is comparatively rare for those who write on the topic of incongruent counterparts to take note of the puzzle as it appears in one-dimensional space. One notable exception to this rule is Wittgenstein, who remarks in the *Tractatus* 6.36111 (1922) that “Kant’s problem about the right hand and the left hand, which cannot be made to coincide, exists even in two dimensions. Indeed, it exists in one-dimensional space.” Wittgenstein then adds his (rather early, 1922) endorsement to the current hypothesis: “the right hand and the left hand are in fact completely congruent. It is quite irrelevant that they cannot be made to coincide. A right-hand glove could be put on the left hand, if it could be turned round in four-dimensional space.”

Wittgenstein’s insight into this one-dimensional variant (which is contained in a drawing that I do not reproduce here) amounts in the

end to this: in Lineland (where all one-dimensional inhabitants eke out their existence in the space described by a line), we might yet have variation apart from sheer length. Let our Linelanders be connected objects whose ends may be either open or closed. ‘L-spear’, as we shall name him, is a two-inch Linelander with no last point-sized part on the left, but with a last point-sized part on the right, while ‘R-spear’ names a two-inch Linelander with no last point-sized part on the right, but with a last point-sized part on the left.⁵ ‘L-spear’ and ‘R-spear’ are as deserving of the title “Incongruent Counterparts” in Lineland as are the pre-flipped characters ‘p’ and ‘q’ in Flatland, and as are your own right and left hands here in three-space.

Consider the worry that, depending on who they have for neighbors, the Linelanders might be subject to a kind of restriction in their sliding movements that would never permit R-spear to get anywhere near the space occupied by L-spear, and thus never to confirm the charge of incongruence. But this complaint misses the point: three-dimensional hands can be congruent in an hourglass space even if neither can pass through the neck of the space to occupy a location once occupied by the other. In Van Cleve’s (1987) clever phrase, “fitting there”, not “getting there”, should be what counts.⁶

Our three instances of the phenomenon, then, suggestively point towards a common treatment. Suppose that Lineland is a subspace of Flatland, and Flatland a subspace of ours. Then just as our Flatlanders ‘p’ and ‘q’ might come upon R-spear and rotate him through their two-dimensional space into a congruent counterpart of L-spear, and just as you might flip ‘q’ itself into a congruent counterpart of ‘p’, so too some four-dimensional prankster may detach one of your hands, take it on a trip, reattach it, and thereby leave you with two left hands as a result (albeit, with the very same two hands you had to begin with).⁷

⁵ Some quick comments: Whose left? Yours now. Imagine that the Linelanders live in some line running left to right given your current orientation. Also, for those who find the descriptions of L-spear and R-spear somewhat obscure, perhaps reflecting on the real line and the partially open intervals (1,2] and [3,4) will help to convey the right idea. Finally, isn’t the phrase “two inches in length” a bit vague, given the ultra-fine level of precision suggested by fancy topological talk of closed and partially open one-dimensional objects? Yes. Replace it with “two Q-units in length”, which is very, very precise indeed.

⁶ The nice hourglass example is his.

⁷ A very enjoyable collection of fictional tales about such journeys can be had. One might start with the 1896 H. G. Wells classic “The Plattner Story”. Or one might look

§3 The Problem of Temporally Incongruent Counterparts

One familiar moral we might be tempted to draw from these observations, then, is that we have here stumbled upon some good reason to accept the metaphysical possibility (perhaps even the actuality) of a fourth dimension of space. The argument would trade on an analogy: just as one-dimensional incongruent figures can be rotated into their counterparts in two-dimensional space, and two-dimensional incongruent figures can be rotated into their counterparts in three-dimensional space, so too, three-dimensional incongruent figures can be rotated into their counterparts in four-dimensional space. But this, of course, requires the metaphysical possibility of four-dimensional space. After all, drawing the metaphysical line at three dimensions of space seems intolerably arbitrary once one sees that the phenomenon of incongruent counterparts reappears among pairs of three-dimensional objects—“Same phenomenon, same treatment!”. But would this argument secure anything really new or important? Isn't the metaphysical possibility of a fourth dimension of space a settled matter—settled by the formal consistency of four-dimensional geometry? Absolutely not. As I noted in the Introduction, mere formal consistency simply does not guarantee metaphysical possibility.⁸

Now for a problem: I believe that this sort of strategy will lead to an unpleasant choice for those who would defend such reasons for believing in the possibility (or even the actuality) of four-dimensional space. Note that we may use the somewhat neglected case of the Linelanders as a model to explore the thoroughly neglected case of *temporally* incongruent counterparts. In the following discussion (let me remind the reader) I assume the four-dimensionalist account of persistence over

for unintentional(?) contributions to this theme. I, for one, think the Boojum Snark is just such a four-dimensional prankster! See Lewis Carroll's *The Hunting of the Snark: An Agony in Eight Fits*. (My suspicion is aroused by rumors of what happens to those who meet the Snark.)

⁸ That logical possibility is no guarantee of metaphysical possibility is well known. But for an extended discussion of this very point in the context of the present debate, once again see Van Cleve 1987, especially the section entitled “Concluding Reactionary Postscript”. Although (unlike Van Cleve) I'm a proponent of the metaphysical possibility of four-dimensional space, I wish to acknowledge that the series of defensive maneuvers he makes in this section are good points for those who don't share my sympathies.

time, and I cheerfully ignore problems of ontological vagueness. L-sphere is a temporally connected sphere which satisfies the following temporal description. It does not exist at or before T1, but it does exist at every time between T1 and T2 (including T2); moreover, it does not exist after T2. R-sphere is a temporally connected sphere which satisfies the following temporal description. It does not exist at or after T4, but it does exist at every time between T3 and T4 (including T3); moreover, it does not exist before T3. Finally, the temporal distance between T1 and T2 is identical to the temporal distance between T3 and T4. L-sphere has a last moment prior to its existence and a last moment of its existence, whereas R-sphere has a first moment of its existence and a first moment after its existence. Whereas L-sphere has no first moment of its existence, R-sphere has no last moment. Despite the fact that they are perfectly congruent spatially, L-sphere and R-sphere are temporally incongruent counterparts. Their relation is the temporal analogue of L-spear and R-spear; L-sphere has “the same temporal size” as R-sphere, but is “temporally open” earlier—on the left, as it were—rather than later.⁹

Consider the worry that, given standard problems with time travel, our spheres might be subject to a kind of restriction regarding the intervals they can occupy such that R-sphere would never be permitted to get “anywhere near” the time occupied by L-sphere, and so never be in a position to confirm the charge of incongruence—they could, after all, be a century apart. But, as before, this complaint misses the point: once again, “fitting there”, rather than “getting there”, should be what counts. And despite the identical length of their lifespans, R-sphere simply does not fit into the same temporal region as L-sphere—hence the temporal incongruence.

Suppose that here (as in our three spatial variants on the puzzle) we attempt to exchange the locations of our counterparts, while confining ourselves to motions possible in restricted dimensions—in this case, to “sliding motions” back and forth along a single temporal dimension. Accordingly, suppose we “slide” R-sphere backwards in time into the temporal vicinity of L-sphere: but once we ensure that R-sphere has no moment of his lifetime after T2, we will be sure to find him already at

⁹ Of course, we needn't appeal to spheres. Temporally extended, two-dimensional tiles or one-dimensional poles or zero-dimensional grains would work equally well.

T1, and once we ensure that he is not present at or before T1, we will be sure to find him lingering around after T2! Neither of our spheres, it would seem, can be made to fit where the other does in time. Unless . . .

Rotating to the rescue? To the extent that we thought the rotating of R-spear in Lineland or of 'q' in Flatland provided evidence for the metaphysical possibility of a fourth dimension of space through which we could flip a right hand into a left one—i.e., to the extent that we accepted a kind of metaphysical justice principle: "Relevantly similar phenomena deserve relevantly similar treatment!"—we should countenance the possibility of flipping R-sphere, so that (post-travel) it would be temporally congruent with L-sphere. But through *what* shall we rotate it? The natural answer is that we should rotate it through the second temporal dimension. But this answer is a natural one only in the sense that it is an analogous one—not in the sense that it is somehow intuitively fitting or satisfying. Even among the champions of four-space, I should expect to hear complaints of the metaphysical impossibility (if not the incoherence) of a second temporal dimension.¹⁰

Not everyone balks at the idea of higher-dimensional time,¹¹ but it is certainly safe to say that the idea is likely to strike us as considerably more suspect than that of four-dimensional space. But why? The reflective mapping that takes us from R-sphere to L-sphere in one-dimensional time can certainly be matched by the translational and rotational mappings that will take us from R-sphere to L-sphere by way of movement through a two-dimensional time. "But this is no proof of higher-dimensional times!"—comes the protest—"It's simply a formal mathematical procedure that justifies a certain kind of talk."

Maybe so. But that's exactly the sort of protest that has failed to move those attracted by the argument from analogy to the possibility of a fourth spatial dimension. It seems to me, then, that to the extent the argument for rotating one member of a pair of n -dimensional incongruent counterparts in $n+1$ dimensions is thought to support the metaphysical possibility of four-dimensional space, it should also be

¹⁰ Compared to the attention lavished on discussions of four-dimensional space, this ground is not all that well-trodden, but for a clear example of someone wholly unimpressed with two-dimensional time-talk see Nusenoff 1976 and 1977.

¹¹ For an intriguing and recent discussion of the possibility of two-dimensional time, see MacBeath 1993. For brief but suggestive earlier discussions see Thomson 1965 and Wilkerson 1973 and 1979.

thought to support the metaphysical possibility of two-dimensional time. Since I am among those who are not prepared to countenance the metaphysical possibility of two-dimensional time, I would counsel others who (like me) are inclined to believe in four-dimensional space simply to abandon the claim that this tempting argument from analogy can provide any justifying reason to endorse its metaphysical possibility.¹²

On the other hand, perhaps we proponents of the metaphysical possibility of four-dimensional space can turn somewhere else to support our view.

A brief digression on why 'size' matters

I expect to hear an objection to the above discussion of the following form. L-sphere and R-sphere *do* fit into the same temporal regions—they differ only by an *instant* at either end—and really, that's no difference at all! This objection deserves a serious (and moderately detailed) answer—partly because it will lay to rest a bad reason for thinking that L-sphere and R-sphere fail to be incongruent counterparts, and partly because it is interesting on its own, and I want to say something about it. Here I think the standard mathematics of the size of regions has taken a detour into the realm of metaphysics—and, finding there very precisely bounded objects to measure, has unreflectively applied its familiar and trustworthy tools, tools that never generated trouble when the only items they had to measure were the regions themselves.

Let me begin my response to this objection by returning to the familiar world of three-dimensional spaces. A spherical region's size is determined by the length of its diameter. Let ' x ' and ' y ' refer to spatial points. Assuming that $x \neq y$, x and y determine a finite (straight) line interval. A single value gives the length of the line interval, whether it be

¹² Of course, those who believe in the metaphysical possibility of four-dimensional space on other grounds can still endorse the metaphysical justice principle—"Relevantly similar phenomena deserve relevantly similar treatment!" Although they could not adopt quite so satisfying a version of the principle, perhaps even those who do not accept the metaphysical possibility of four-dimensional space can ground a claim to one form of similar treatment with reference to a non-orientable three-dimensional space in which a right hand can be taken to its counterpart.

closed (in virtue of containing both of its terminating points, $[x,y]$) or partially open (either in virtue of containing neither of its terminating points, (x,y) , or in virtue of containing exactly one of its terminating points, $[x,y)$ or $(x,y]$).

Now imagine two compossible spheres (hereby named 'Closed' and 'Open'). Closed is a sphere exactly occupying a region which contains all of its boundary points as members. Open is a sphere exactly occupying a region which contains none of its boundary points as members (assuming for the purpose of this example that space is only three-dimensional). Closed, but not Open, is bounded by a two-dimensional sphereshell which it also has as a part, whereas Open, but not Closed, has every point that it occupies in its own interior. Given our earlier remarks, we are still free to stipulate that both of our spheres have diameters of the same length—say of length 1—and this despite the fact that the salient features just noted guarantee that the diameter of Closed is in significant respects different from that of Open, since those line intervals are themselves closed and partially open regions, respectively.

So, we have two spheres of the same size with different surfaces. Nothing surprising here. Yet in our comparative judgments of size of pairs of such precisely described objects, we have a tendency to focus singlemindedly on these rather technical accounts of length as properties of spatial regions (and derivatively as properties of the material objects that fill them). Unfortunately, this tendency blinds us to another curious and neglected feature of material objects, a feature whose most intuitive description also comes by way of the terms 'length' and 'size'.

Let 'Alpha' name a third solid, which is a worldmate of Closed and Open—a solid bounded by a sphereshell that sports a diameter five times that of its brother spheres. Like Closed, Alpha is also a solid exactly occupying a closed region, but, unlike Closed, Alpha has two surfaces. As just mentioned, on its outermost surface Alpha is bounded by a two-dimensional sphereshell, but Alpha hides a secret. Alpha also contains a single (wholly empty, open-sphere) internal cavity, and thus within its depths Alpha is bounded by a second two-dimensional sphereshell, a sphereshell touched at all points by the cavity within. This wholly empty, open-sphere cavity (let us further stipulate) sports a diameter the same length as those of our original spheres, Closed and Open—that is, a diameter of length 1.

Here's the startling bit: despite the fact that they are the same size, Open can be transported into the cavity, and Closed cannot. After transportation, Open would fit snugly within Alpha—so snugly that they would jointly occupy a connected region of space with no overlap. But try to transport Closed into Alpha, and catastrophe awaits. The surface of Closed (i.e., the two-dimensional sphereshell that bounds our little sphere) will collide with one of the surfaces of Alpha (i.e., with the two-dimensional sphereshell that serves as the boundary between our big solid and its cavity). If the co-location of distinct sphereshells or the interpenetration of three-dimensional material objects is impossible (and for those sympathetic to some forms of co-location or interpenetration, let us also insist that the relevant objects be of the same impenetrability-kind), then so are our hopes of a successful transportation. But even if such co-location or interpenetration were possible, the fact remains that Closed spills over into some of the space occupied by Alpha upon transportation, whereas Open doesn't. That's enough of a difference to take notice.

A cavity is an internal hole cut off from the outside world by its host. Cavities come in different shapes and sizes (in fact, I should think that for every shape and size a material object might take, some cavity could be just so). With some hope of generality, then, I submit the following (and I think overwhelmingly intuitive) principle concerning one sense of 'size':

(S): If x can completely fill a cavity without colliding with the cavity's host while y can completely fill the same cavity only if it also collides with the cavity's host, then x is of a smaller size than y .

We may require the proviso 'without suffering certain kinds of change' in (S) to guard against the cheat which would, for example, consist in rearranging the point-sized parts of Closed (in some way consistent with its persistence) so that it, too, would come to occupy an open region of the right shape and size, and only then attempt transport. (Such a strategy becomes an intriguing possibility if Closed is both composed of point-sized parts and extended, for then—since every extended region has the same cardinality—careful redistribution of the point-sized parts of Closed would permit the construction of *any*-size extended object you please, from galaxy-sized spheres without cavities or cracks to thimble-sized spheres without crowding or coinci-

dence!) By (S) and our discussion, then, despite having the same length/extension/measure/size (in the most common senses attributed to terms in that family), Open is clearly of a *smaller size* than Closed (in another perfectly straightforward sense of that term).

When making comparative judgments of size and fit between objects and regions, we may have very different purposes in mind. We may simply be interested in a certain property of regions of space insensitive to certain topological distinctions (a feature we may take to be inherited in some sense by their occupants), or we may be interested in a theory of material objects, surfaces, boundaries, receptacles, contact, coincidence—and even incongruent counterparts. Accordingly, when asking ourselves whether one object fits in a region occupied by another, we should remember that just which interpretation we take of ‘size’ matters.

§4 Incongruent Counterparts and Substantivalism

Although it may not bear directly on the question “How many dimensions has space?”, the phenomenon of incongruent counterparts has sometimes been taken to teach a slightly different lesson: namely, that substantivalism (as opposed to relationism) is true. I find this argument quite intriguing, but I have a worry about its level of success that has gone unnoticed in the literature. Those interested in learning of a reason for thinking that the current version of the appeal to incongruent counterparts is indecisive on this issue as well are invited to read on, while those who wish to move onto other philosophical reasons for believing in hyperspace are encouraged to skip ahead to section 5.

An exceedingly brief history of an argument: Attempts to appeal to the distinction between right and left in arguments for substantivalism can be traced to the Kantian thought-experiment involving a solitary hand in an otherwise empty universe (Kant 1768). Unfortunately, the Kantian claim that a solitary hand in an otherwise empty universe would have to be either a right hand or a left hand seems to be undermined by the observation that whereas orientable three-space would demand a unique handedness, non-orientable three-space and four-space would not. Graham Nerlich (1973), however, advanced the debate by arguing that (in any kind of space) a solitary hand in an

otherwise empty universe would have to be either such that it could have an incongruent counterpart or else such that it could not have an incongruent counterpart; in the first case, the hand would be enantiomorphic, and in the second it would be homomorphic. Nerlich then argued that these features of a hand would have to be determined by its relation to the surrounding space, with an orientable three-space fixing it as enantiomorphic, and a non-orientable three-space or four-space fixing it as homomorphic. On either scenario, he concluded, space would need to be substantial, in order to stand in the requisite relation. Unfortunately, Nerlich's claim that a solitary hand in an otherwise empty universe would have to be either enantiomorphic or homomorphic turns on whether congruence depends on the possibility of bringing the relevant objects into coincidence—a presupposition exposed and compellingly challenged by James Van Cleve.¹³ As a friendly amendment, Van Cleve further advanced the debate by invoking yet another pair of properties, at least one of which would have to be exemplified by a solitary pair of hands in an otherwise empty universe—namely, either being permanently fixed in orientation or being not permanently fixed in orientation. Van Cleve then showed how to extend Kant's and Nerlich's argument to show that these features of a pair of hands would have to be determined by their relation to the surrounding space, with an orientable three-space fixing them as permanently the same in orientation, and a non-orientable three-space or four-space fixing them as not permanently the same in orientation. Once again, then, on either scenario, space would need to be substantial, in order to stand in the requisite relation. Despite his improvement of the argument, Van Cleve hesitated on the question of its success, following Lawrence Sklar (1974) in entertaining responses that account for the relevant feature of a pair of hands by appealing only to the limited tools available to the relationist.¹⁴

Even if the relationist should find himself in trouble in furnishing the details of this response, I think the Kant–Nerlich–Van Cleve argument can be resisted in another way that is worth consideration.

¹³ That is, it depends on the possibility of coincidence holding fixed certain (perhaps contingent) features of the scenario. See Van Cleve 1987.

¹⁴ Also see Van Cleve 1987: sect. XV and its discussion of the question “can the relationist define dimension?”

Let me begin with an informal presentation: suppose, if you will, that we have a pair of hands that are the same in orientation (say, two right hands, H_1 and H_2). Further, suppose that the particles composing H_1 at T_1 jump discontinuously at T_1 to their assignments in its reflective mapping. If post-jump the particles still compose a hand (and indeed still compose H_1), then H_1 will have become a left hand, and we will be correct to conclude that our original pair of hands did not, in fact, have the property 'being permanently the same in orientation'. The argument under scrutiny, however, suggests that this feature of the pair of hands depends on their relation to the space in which they are embedded, and more specifically, on what is now allegedly revealed to be a substantial, orientable three-space or four-space. But here's the rub. The mechanism for switching their orientation did not depend on rigid motion through a non-orientable three-space or four-space; rather, it depended upon discontinuous motion which took the particles composing the hand to their reflective mapping—and that's a trick which the relationist is able to explain as well as the substantialist. I take it that the relationist has the resources to explain the discontinuous motion of a particle. The pressing question, then, is whether a hand can survive this sort of change in its location. Before pressing on, perhaps one further stipulation would be in order: let us suppose that the x s are the particles that compose H_1 at T_1 , and further suppose that at times after and arbitrarily close to T_1 , the x s are already located at their new positions fixed by the reflective mapping in question. Fortunately, then, there are not two puzzles—one of discontinuous motion and one of temporal gappiness—but only the puzzle of discontinuous motion. If it survives at all, H_1 is always present somewhere or other throughout the thought-experiment. The puzzle of preserving identity through this kind of change is puzzle enough, however.

A more careful presentation: As noted in the Introduction, I am a universalist with respect to composition and a four-dimensionalist with respect to persistence, and thus I am committed to the conclusion that just as the (instantaneous) pre-jump temporal parts of the x s compose something, so too the (temporally closest) post-jump temporal parts of the x s compose something. Moreover, it seems clear that each of the respective pluralities composes a temporal part of a hand. (Note: if anyone wants to insist that a *genuine* hand has to have certain functional

or historical properties, we could conduct the argument instead in terms of less problematic examples of three-dimensional incongruent counterparts, but nothing would really be gained thereby, and the familiar imaginative grasp we have on these puzzles when they feature objects as familiar as hands might be lost.) The really significant question, I suggest, is whether it would be one and the same hand or merely a reflective *doppelgänger* that we find in the new location—or, what amounts to the same thing, whether the temporal part of a right hand that we find pre-jump is a temporal part of one and the same hand as is the temporal part of a left hand that we find post-jump.

Why would anyone be inclined to deny the identity claim? Elsewhere I have followed the lead of Dean Zimmerman in exploring the relation of immanent causation, a relation which plays a more central role in the persistence of objects such as a hand than does mere spatio-temporal continuity.¹⁵ Zimmerman's efforts on this score are somewhat technical, but the core idea is rather straightforward: suppose that we have a perfectly seamless spatio-temporal continuity between a series of successive hand-stages throughout some interval of time; if it should just so happen that the hand-stage at the t -moment of that interval is wholly causally unrelated to the relevant hand-stages immediately before t , then the stages in question are not stages of one and the same hand—even if they are qualitative duplicates of one another. Persistence of an object such as a hand requires that the earlier stages of that object be among the causes of certain features of its later stages. A principled way of putting the matter is as follows:

(ICH): Necessarily, if a hand, H , persists throughout an open temporal interval, T , then for every instant, t , in T , there is an open interval of time, T^* , with t as its point-limit such that the sum of H 's temporal parts that exist during T^* is a partial cause of H 's temporal part at t .¹⁶

¹⁵ See my 2001*a*: chs. 4 and 7. In the following two paragraphs I borrow from that discussion. Zimmerman's suggestive 1997 revived, clarified, and expanded the literature on the relation of immanent causation.

¹⁶ This principle of immanent causation for hands, (ICH), is a modified version of a more general principle, (IC), put forth in Zimmerman 1999, in which 'hand' is replaced by 'material object'. For the record, I reject the more general (IC) on the grounds that some material objects can persist (i.e., can have non-simultaneous temporal parts) even when there is no causal connection between the parts in question. I am happy to grant, for example, that the fusion of the temporal part of my right hand up to and including the present moment with the temporal part of your right hand at times after but

Note that (ICH) states only a necessary condition and is incomplete. A full-dress version of the causal requirement would specify the nature and extent of the causal dependence of the features of H 's temporal part at t upon its predecessors, but perhaps it has enough content to put us in a position to see why someone might balk at the idea that a hand can survive a discontinuous jump—such jumps threaten to forfeit causal continuity, which would in turn forfeit persistence. The debate, then, should center on the question of whether such jumps really do interrupt the relevant immanent causal connections. I, for one, do not think that such jumps must prevent immanent causality (nor do I think that temporal gaps force a break in immanent causality), but I wish only to record those views here and to postpone discussion until Chapter 5, when I will turn my attention more fully to certain questions about superluminal motion and superluminal causation.

Accordingly, since (in the end) I do not think that discontinuous jumps need interfere with immanent causal connections, and since I do not see any other reason to deny the relevant persistence claim, I presently conclude that the relationist can stand firm against the Kant–Nerlich–Van Cleve argument for substantivalism as it is currently put forth. The general line of reasoning, though, can be revived with the best “fix” coming by way of enriching the pair of properties which drive the case for substantivalism as follows: any pair of hands must either have the property ‘being permanently fixed in orientation while their change in location is restricted to rigid motions’ or else ‘being not permanently fixed in orientation while their change in location is restricted to rigid motions’.¹⁷ The rest of the argument may then proceed as before, while remaining neutral on the possibility of persistence through discontinuous motion. Of course this fix depends on a somewhat liberal view of properties and an analysis of ‘rigid motion’ which rules out discontinuous jumps, but without some such enrichment, I suspect that the relationist will have nothing to fear from incongruent counterparts and their related phenomena.

arbitrarily close to the present moment is a perfectly good persisting material object, hand-shaped at every moment it is present; I just deny that it is a hand. In general, (IC) states a condition on the persistence of objects that satisfy certain familiar sortal terms, but not on material objects as such. I will take up this theme again in Ch. 5.

¹⁷ Thanks here to John Hawthorne for conversation.

§5 The Fine-Tuning Argument for Hyperspace

Arguments from design are like arguments for skepticism or against free will or about trees falling in abandoned forests—philosophers often adopt the posture that the line of reasoning is transparently bad and trivially easy to refute, but then, once the time for refutation comes, it turns out that these confident folk do not all speak with one voice about just what is wrong with the arguments.

The most famous family of arguments from design are theistic arguments, and just a bit of digging around will quickly convince one that there are some remarkably unsophisticated branches of this family. Recently, though, a rather more sophisticated branch of this family has emerged, one whose members are classified under the general heading “fine-tuning arguments”. As a defense for theism, the fine-tuning argument is suggestive and intriguing, but it could hardly claim to establish with any authority the existence of something divine. Instead, its proponents aim for something more modest—that whereas it does not establish the truth of theism or even the probability of theism, it does provide very significant evidence which (if left unanswered) can render theistic belief not unreasonable at the end of the day. I would like to emulate this modesty and adapt the fine-tuning argument to my own ends. For those who do not see the argument as a likely path to God, perhaps it will instead appear to lead to hyperspace.

No need to reinvent the wheel. Perfectly serviceable and clear versions of the general strategy at work in these arguments are readily available, and in the next few paragraphs I will borrow (with a few deviations) from the rather elegant and accessible presentation offered by Robin Collins.¹⁸

By ‘life-permitting cosmic conditions’ I shall mean a set of conditions, *C*—which include facts about the numbers, types, and distributions of existing particles, facts about the relative strengths of the fundamental forces, and facts about the various laws of nature—such

¹⁸ I find it difficult to determine how best to engage and reference the (enormous) literature on this issue. Collins 1999, however, seems to me to offer such a clear and accessible presentation, I think it better to direct an interested reader to his introductory essay and to the intriguing papers in Manson 2003 than simply to clutter this section with references to the literature on Bayesian reasoning.

that if C were to obtain in some region, it would be physically possible for sentient things to exist in that region. Of course, there need not be just one, unique, such set of conditions. Maybe there are many different ways the universe could have been with respect to its inhabitants and their laws that would have been life-permitting. Similarly, there need not be just one unique set of non-life-permitting conditions. Maybe there are many different ways the universe could have been with respect to its inhabitants and their laws that would not have been life-permitting.

By 'the fine-tuning' I shall refer to the claim that the range of those values for the cosmic conditions that we have good reason to believe are life-permitting is very small compared with the total range of parameters for which we can reasonably determine whether or not they are life-permitting. Note that we are carefully avoiding the claim that for each set of cosmic conditions we are in a position to determine whether or not those conditions are life-permitting, and thus that we are talking about a so-called illuminated range when making the relevant comparative judgment. How small is small? This is a notoriously delicate question, owing to the complication of an infinity of possible worlds on either side. But the common maneuver is to ignore the point about one-one correspondence when dealing with sets with infinite membership, and instead to talk about ranges (e.g., the range of life-permitting values is to the total range of values as is a one foot by one foot target to a galaxy-sized dartboard . . . very small). Finally, it is important to note that by 'fine-tuning' I am not including the (true) thesis that our universe itself exhibits life-permitting, cosmic conditions.

Sometimes an image is helpful: imagine that you are the owner of a huge map that represents a two-dimensional region as large as the galaxy. There are even bigger maps for sale that accurately depict an even larger territory, but they're expensive, and you're proud of what you have. (This is our analogue of the illuminated range.) The map is divided into squares, each of which represents one square foot, and there is exactly one special square (call this the 'secret square') that has a property not had by any of the other squares on the map—it is, say, colored blue rather than red. (This is our analogue of the ratio of the range of life-permitting conditions to the range of non-life-permitting conditions.) Your map has borders, and you have no idea whether the larger maps would have contained many more blue squares beyond the

region represented by the map you own. (This is our analogue of our admission of ignorance about whether certain kinds of remote cosmic conditions are life-permitting.) As luck would have it, a game will soon be played in which exactly one of the squares on your map will be declared the winner in virtue of containing a point-sized subregion of the map to be selected randomly. (This is our analogue of the fact that there is a unique set of cosmic conditions actually in force—marred a bit, I know, by the fact that the cosmic conditions hold eternally and the game occurs at a particular moment in history, but such are the hazards of helpful images.) Now it turns out that something of great value will be had if the secret square is the fortunate one. Moreover, nothing of great value will be had if one of the other squares is declared the winner—but something of great disvalue will transpire: should one of the other squares win, you will be immediately killed and won't be around to see the outcome of the game. (This is our analogue of the idea that only a cosmos with life-permitting conditions is a cosmos in which there are subjects around to reflect on the game at all.) Finally, the game is played, and the secret square is selected! (This is our analogue of the fact that our universe contains life-permitting conditions.) It all makes you wonder a bit about what's going on.

In the argument to come I will invoke a principle about evidence, which may be formulated as follows:

Whenever we are considering two competing hypotheses [H_1 and H_2] an observation [O] counts as evidence in favor of the hypothesis under which the observation has the highest probability (or is the least improbable). Moreover, the degree to which the evidence counts in favor of one hypothesis over another is proportional to the degree to which the observation is more probable under the one hypothesis than the other. (Collins 1999: 51)¹⁹

Some comments on terminology (also borrowed from Collins): by 'two competing hypotheses' I will mean (rather narrowly) two hypotheses from whose conjunction we can derive a contradiction. And by 'probability under a hypothesis' I will mean conditional, epistemic probability. Whereas epistemic probability is just the degree of credence we should assign a proposition, given our total evidence, the conditional epistemic probability of a proposition P on another proposition Q is the

¹⁹ Collins calls this the prime principle of confirmation.

degree to which the proposition Q *of itself* should lead us to expect that P is true.

Permit me to illustrate the principle with another hopefully helpful image. Let the relevant substitutions be

O = the cards on my desk are arranged by alphabetical suit, ace to king.
 H_1 = their arrangement is the result of random shuffling.
 H_2 = their arrangement is the result of my trying my best to purposefully so arrange them.

Now suppose that you come to know that O , and that you begin to consider competing hypotheses H_1 and H_2 . Let us employ the general principle just introduced.

There is no need to ask about the epistemic probability of O . Our working assumption is that you already know O , and thus the epistemic probability you assign O is presumably very high, no matter which of the competing hypotheses you also happen to accept. Rather, you need to ask the questions (i) “to what degree should H_1 of itself rationally lead me to expect that O is true?” and (ii) “to what degree should H_2 of itself rationally lead me to expect that O is true?”

The first answer is *very low*—“1 chance in 52!”—whereas the second answer is presumably *very high* (since I tend to achieve a pretty impressive success rate when attempting such minor tasks). Consequently, our principle declares that O provides considerable evidence for H_2 over H_1 . Here comes the modest bit. I am not suggesting that this is conclusive evidence; nor is there any reason to believe that it is our sole evidence. For all I’ve said thus far, my colleague could have so configured the cards, and we could have caught him in the act on videotape. But unless something or other matches or undercuts the evidence we have, O provides considerable evidence for H_2 over H_1 .

It is an easy task to muster support for this general principle by pointing out that it has a widely accepted range of applicability ranging from its employment in the most significant and technical of research projects to the most mundane and casual reasoning of our daily lives. In fact, some go so far as to emphasize that a variant of this principle may underlie all scientific reasoning whatsoever.²⁰ Those are impressive

²⁰ For more discussion, see Collins 1999: 53.

credentials, indeed. If there is a problem in the argument to come, it won't be located here.

Turning our attention now to the version of the fine-tuning argument I wish to investigate, let the relevant substitutions be

O = the cosmic conditions actually in force are life-permitting.

H₁ = the hypothesis of a plenitudinous hyperspace: spacetime is a connected manifold with more than three spatial dimensions, yet the manifold can be partitioned into subregions which vary independently with respect to their cosmic conditions.

H₂ = the hypothesis of a lonely three-space: spacetime is a connected manifold with only three spatial dimensions, all subject to the same cosmic conditions.

The fine-tuning argument for hyperspace

1. Given two competing hypotheses, H₁ and H₂, an observation, O, counts as evidence in favor of the hypothesis under which the observation has the highest probability. (Moreover, the greater the discrepancy, the stronger the evidence.)
2. The fine-tuning claim is true.
3. If the fine-tuning claim is true, the existence of life-permitting cosmic conditions is very probable under the hypothesis of a plenitudinous hyperspace.
4. If the fine-tuning claim is true, the existence of life-permitting cosmic conditions is extremely improbable under the hypothesis of lonely three-space.
5. Hence, the existence of life-permitting cosmic conditions counts as very strong evidence in favor of a plenitudinous hyperspace over a lonely three-space.

I will begin my critical evaluation of this argument first by acknowledging that it simply assumes that there are life-permitting cosmic conditions. But no harm is done, for if that presupposition were false, none of us would be around to say so. One might complain that this is a bit quick, and that if, for example, idealism were true, we might well be able to reflect on the problem at hand as to whether any sentient creatures or cosmic conditions permitting them were among the real things or not.

Fair enough, but I remind the reader that I began with materialism as a starting point in the Introduction; anyone who wants to escape the above argument by converting to idealism need not fear any obstacle in his path from me. Second, hypotheses H_1 and H_2 qualify as competing hypotheses (even in our very restrictive sense), since we can derive a contradiction from their conjunction. Third, the conclusion of the argument does not say that the existence of life-permitting cosmic conditions proves the hypothesis of a plenitudinous hyperspace, or even that it makes it likely that that hypothesis is true. Justifying those much stronger claims would require assessing the full range of available evidence for the relevant hypotheses. The argument does, however, purport to uncover one bit of very strong evidence for the fan of hyperspace—evidence which can perhaps be undercut by even better evidence for the opposition, but evidence which, if left unchallenged, may render belief in hyperspace not unreasonable at the end of the day.

Premise (1) is just our general principle of reasoning together with the claim that the greater the difference in probability, the greater the evidence, and premise (2) simply asserts the fine-tuning claim. Notwithstanding the suggestion that the physical parameters are themselves metaphysically necessary (and hence that life-permitting cosmic conditions are inevitable), the evidence for the fine-tuning claim seems to me to be very compelling indeed.²¹ In fact, I would even venture the guess that this claim is established more firmly than are some popular scientific orthodoxies, the skeptical questioning of which often invites charges of gross incompetence (or perhaps even of wickedness).

The genuine targets for complaint about this argument, I believe, are premises (3) and (4) and the claim that the argument really is able to show something worth getting worked up about.

Premise (3) makes the claim that, given the fine-tuning, the hypothesis of a plenitudinous hyperspace should of itself lead us to very high expectations that the cosmic conditions will be life-permitting. Why? Presumably because, on the assumption of a sufficiently rich plentitude, there will be enough distinct regions in which the physical parameters differ independently to render it unsurprising that at least some of them

²¹ For an accessible catalogue of some of the bits of evidence for the fine-tuning argument, see Leslie 1989, and for a more detailed and comprehensive presentation see Barrow and Tipler 1986. For a response to the suggestion that the cosmic conditions are metaphysically necessary, see Collins 1999 and Rees 2003.

fall in the life-permitting range. One has little reason to be surprised when issued a share of the lottery jackpot if one has purchased tickets for 80 percent of the possible outcomes. Let us be careful not to confuse premise (3) with the claim that the proponent of the hypothesis of a plenitudinous hyperspace should assign a high probability to the claim that there are life-permitting, cosmic conditions; everyone should do that. But we will avoid this mistaken interpretation of premise (3) if we are careful not to confuse conditional epistemic probability with mere epistemic probability.

Premise (4) makes the claim that given the fine-tuning, the hypothesis of a lonely three-space should of itself lead us to very high expectations that the cosmic conditions will not be life-permitting. Why? Presumably because one assumes on that hypothesis that the values for the cosmic conditions are selected randomly, and because the fine-tuning claim suggests that the chances of hitting the mark randomly are about the same as those of a randomly thrown dart hitting a one-foot square bulls-eye on a galaxy-sized dartboard. Without too much exaggeration, that seems sufficiently low to merit the description 'extremely improbable'. Still, this assumption about how the values are selected is negotiable, and we shall return to a reply that challenges the assumption below.

§6 Objections to the Fine-Tuning Argument for Hyperspace

The benevolent elves objection

Objection: We can grant the whole argument, but we need not get too excited about the result, for a little reflection reveals that given the fine-tuning, the existence of life-permitting cosmic conditions also counts as very strong evidence of elvism over a lonely three-space. (Note: elvism is the view that there exist a bunch of benevolent elves who live in a spacetime disconnected from ours and who determine and maintain the cosmic conditions that govern us.) Yet, despite this allegedly gripping evidence provided by a fine-tuning argument for elvism, none of us is likely to confess to being a proponent of that silly view, and so the argument can't really provide very impressive evidence after all.

Response: True, given the fine-tuning, the existence of life-permitting cosmic conditions also counts as very strong evidence of elvism (and a

host of other ‘-isms’) over a lonely three-space and for exactly the same reasons that it provides very strong evidence of a plenitudinous hyperspace over a lonely three-space. Note once again, however, that neither of the relevant arguments makes the claim that the existence of life-permitting cosmic conditions *proves* the hypothesis of a plenitudinous hyperspace or elvism, or even that it makes it more likely than not that one of these hypotheses is true. Once again, justifying such an additional claim would require assessing the full range of available evidence for the relevant hypotheses. Rather, the arguments demonstrate only that we have here uncovered one bit of very strong evidence for the plenitudinous hyperspace camp against their lonely three-space opponents and for the elvist camp against the foes of elvism. Of course, the hyperspace theorist may think herself better positioned to resist the arguments of the lonely three-spacers than is the elvist to resist the arguments of non-elvists, and when it comes time to assess the full range of available evidence, this significant advantage may resurrect interest in the original argument, after all.

The theistic, lonely three-space objection

Objection: We should not endorse premise (4) in the argument. As suggested above, our tendency to endorse it comes from the assumption that on the hypothesis of lonely three-space, the values for the cosmic conditions are selected randomly. But that assumption gratuitously assumes the truth of atheism—and we should certainly be cautious about such a starting point when discussing an argument from a family most of whose relatives are aimed at establishing the truth of theism. Why would a theistic, lonely three-space lead to rejecting premise (4)? Presumably because God would be essentially perfectly good, and thereby would be motivated to create creaturely persons with the freedom to interact and to bring about both moral value and the value that arises as a result of certain sorts of interpersonal relationships. And such actions require, it would seem, life-permitting cosmic conditions. Being essentially omnipotent, then, God would have the power to bring about what he was sufficiently motivated to bring about, and life-permitting cosmic conditions would be more or less guaranteed. Consequently, the plausibility of premise (4) depends among other things on atheism, and whereas there are multiple ways to be a proponent of our

second hypothesis, they do not agree on the conditional probability of life-permitting cosmic conditions given lonely three-space and the fine-tuning.

Response: I say that this is a good objection, but then I'm willing to go theist. I did promise to put my theistic sympathies on hold until Chapters 7 and 8, however; so for the moment simply consider this dilemma: Either God exists or not. If God exists, then philosophical arguments for hyperspace can be motivated by certain outstanding problems in the philosophy of religion (as they will be in Chapters 7 and 8). If God does not exist, then the theistic, lonely three-space objection is a failure, and the fine-tuning argument for hyperspace is still firmly in the running. Despite their differences, then, theists and atheists alike may at least join forces in endorsing a plenitudinous hyperspace (albeit for different reasons).

The many-worlds objection

Objection: Once again, we can grant the whole argument, and (unlike the proponent of the benevolent elves objection) we can also grant its significance, but we should not think that it provides particularly strong evidence for a plenitudinous hyperspace. What is salient about that hypothesis is that it invokes terrifically many different regions that vary independently with respect to their cosmic conditions. But there are other hypotheses in the neighborhood which share that salient feature without special appeal to hyperspace. Such alternatives include (i) the countless Lewis worlds (i.e., spatio-temporally and causally isolated universes that David Lewis (1986) argued for on the grounds of theoretical unity and economy); (ii) the plentiful domains of inflationary cosmology; (iii) the abundant universes born of quantum vacuum fluctuations; (iv) the ancient idea of an eternal return in an oscillating big bang/big crunch universe; (v) the modern M-theory speculation of a cyclical big splat/big bounce sequence for pairs of three-branes floating in a multi-dimensional space; and (vi) the branching cosmology posited by many worlds interpretations of quantum theory.²² Consequently, whereas the argument has some force, its real lesson is that

²² For an overview of the different many-worlds hypotheses, see Leslie 1989: ch. 4 and Greene 2004: ch. 13.

life-permitting, cosmic conditions yield good reasons to prefer a many worlds hypothesis over a single, lonely three-space—but not to favor some particular flavor of a many worlds hypothesis, such as a plenitudinous hyperspace.

Response: Consider two very different kinds of reply. First, the objection gives more ground than it should, since none of the many-worlds hypotheses receives any real support from the fine-tuning argument. Second, the objection may be correct insofar as it suggests that the fine-tuning argument doesn't favor one flavor of a many-worlds hypothesis over another, but it is incorrect if it further suggests that there are no other avenues available to us for tie-breaking. The first style of objection has been raised in different forms, including, for example, those that challenge the coherence of probability judgments concerning "random draws" from a pool of uncountably many candidates (see McGrew, McGrew, and Vestrup 2001) and those that worry about fallacious reasoning underlying the relevant probability verdicts.²³ The second style of objection requires exhibiting the tie-breaking considerations that it hints are available, and there is a staggering amount of literature to be sifted through here—including, for example, the ontological extravagance objection to Lewis worlds, and the substantial physics/philosophy literature on the strengths, weaknesses, and intelligibility of inflationary hypotheses, quantum fluctuations, string theory, and many-worlds quantum theory.

Rather than entering into these debates, let me close this chapter with a brief reflection. One very popular objection to taking the fine-tuning argument as evidence for the many-worlds hypothesis is that there is no existing account of the etiology of the allegedly many worlds which doesn't itself require fine-tuning. In other words, positing many worlds isn't a way of dealing satisfactorily with the observation of life-permitting, cosmic conditions, but instead is simply a delaying tactic which shifts the surprise up one level—i.e., "Why would the mechanism which generates the many worlds be fine-tuned so as to produce some life-permitting worlds rather than worlds all incompatible with life?" (see Collins 1999 and Craig 2003). There is bite to this objection, especially when the mechanism in question is something like the

²³ See White 2000, Mellor 2003, Dembski 2003, and for a response, Manson and Thrush 2003.

vacuum fluctuation models or the oscillating big bang/big crunch sequences—i.e., mechanisms especially vulnerable to the ‘need-for-further-fine-tuning’ complaint. It is promising to note, however, that the many worlds of a plenitudinous hyperspace do not need an independent or prior physical mechanism which produces them. There need be no big crunch or conflagration from which the next world epoch arises; there need be no splitting or pinching off of baby universes; there need be no inflationary scenarios with disconnected descendants but a common ancestry. Rather, on the (atheistic) plenitudinous hyperspace model, there is simply a connected manifold with more than three spatial dimensions, which is partitioned into subregions that vary independently with respect to their cosmic conditions. No fine-tuning need set the stage for a cosmoi-producing mechanism if there is no cosmoi-producing mechanism in play—the existence, dimensions, occupants, forces, and laws at work in this particular kind of multiverse are brute facts, exactly the kind of brute facts which the (atheistic) proponent of the hypothesis of a lonely three-space has always been satisfied with before.

We all must live with brute facts of some kind or other (recall the Introduction). Unlike other many-worlds accounts, the hypothesis of a plenitudinous hyperspace avoids the objection from etiology by appeal to bruteness, while locating the relevant brute facts at an *exceedingly* general level and hardly in an *ad hoc* fashion. To the extent, then, that one takes the fine-tuning argument to point towards many worlds rather than to a Designer, the hypothesis of a plenitudinous hyperspace may have an edge on some of its competing many-worlds rivals.

2

Receptacles: Hosts and Guests

§1 The Opponents and the Playing Field

A *receptacle* is a region of space possibly exactly occupied by a material object.¹ By ‘receptacle’ I do not mean a hole. (Curiously, though, like regions, holes can host guests, and, like guests, holes can occupy regions—but in accordance with my occupancy account of material objects, I take holes to be material entities, and thus to be counted among the guests in this chapter.)² I believe that any region is a receptacle. Others disagree, often emphatically! In the interests of properly representing such disagreement and of forwarding the cause of my liberal view of receptacles, I will draw on the machinery presented in the Introduction on the topological notions of open, closed, and partially open objects and regions.

Since I believe that any region is a receptacle, I am willing to acknowledge the possibility of open, closed, and partially open material objects of all sizes, shapes, and surfaces—including three-dimensional solids, two-dimensional plane-walls and sphereshells, one-dimensional ribbons and poles, and zero-dimensional grains and fusions of countably many grains.³ But how shall we represent the opposition? Those opposed, it turns out, do not all speak with one voice, and thus we have several battles to engage. Fortunately, not all of the *many* alternative

¹ The sense of ‘possibility’ relevant here is metaphysical, not logical, physical, epistemic, or otherwise.

² I think it is interesting to note that the substantialist who agrees with me that holes can exactly fill a receptacle and can further host a guest of their own is in a position to recognize a three-way instance of co-location between a region and two material objects. Admitting this phenomenon does not, however, run counter to the ban on the co-location of material substances that I endorsed in the Introduction.

³ But let us not stop here. . . . I also see no reason to ban ‘topological monsters’ such as space-filling curves, spiked spheres, and various other cross-dimensional marvels.

views are equally compelling. So I will be selective. In this chapter, I wish to target three rather prominent and intuitively plausible competitors to my liberal view of receptacles, which I identify as follows:

O-theory: Necessarily, all material objects are open.⁴

C-theory: Necessarily, all material objects are closed.⁵

T-theory: Necessarily, all material objects are (at least) three-dimensional, whether open, closed, or partially open.⁶

There are, of course, hybrid theorists to be identified, as well as opponents of the liberal view of receptacles whose opposition is not centered on any thesis concerning boundaries or dimensionality. For example, one who denies the possibility of scattered objects, or who denies the possibility of material objects whose parts fail to satisfy some causal relation or other, need not be an O-theorist, C-theorist, or T-theorist to join in the campaign against the liberal view. But in my judgment, sufficient attention has been paid to these latter opponents, and in the present chapter I hope to win some converts to the liberal view of receptacles by defeating a trio of rivals whose opposition is founded on some thesis concerning boundaries or dimensionality.

§2 Some Ground-Clearing and Stage-Setting

Before we begin, I have two tasks to perform. First, a bit of ground-clearing: I want to dismiss a bad (but popular) argument. What, we may ask, is wrong with the following bit of reasoning? It's pretty obvious that you and I are three-dimensional, and we certainly face no insurmountable philosophical puzzle that forces upon us two-dimensional or one-

⁴ Cartwright 1987: 172 (following Descartes' lead) is an O-theorist.

⁵ Franz Brentano (following the lead of Suárez in his *Disputationes Metaphysicae*) is a C-theorist; see Brentano 1988. For a fascinating look at the philosophical origins of topology and a brief history of some of the medieval and modern reasons to be either an O-theorist or a C-theorist or a T-theorist, see Zimmerman 1996*b*. Interestingly, many such reasons turn on puzzles regarding the possibility of contact between material objects. In the next chapter I will say much more about an analysis of contact which presupposes the liberal view of receptacles.

⁶ See the man in the street. This is his view. Well, the first half is. Well, the first half minus the modal operator. Let's just say that it is a highly plausible, deeply intuitive view, revived in the early 1900s by Alfred North Whitehead (following the lead of William of Occam); see Whitehead 1916.

dimensional items. Let us, then, be conservative and join ranks with the T-theorists. After all, can't we analyze away our apparent commitment to surfaces and edges and corners as effectively as we analyze away our apparent commitment to wrinkles and smiles? (For the record, I think that something like this bit of reasoning is responsible for a great deal of the suspicion directed at the liberal view of receptacles.)

Well, here's what's wrong with it. Whether or not we face any such philosophical puzzle that forces upon us such odd things, it is *not* obvious that you and I are three-dimensional—not obvious at all. Let us grant without argument that you and I are material objects and that we are spatially located (no hidden appeal to idealism or dualism here). And let us also grant that we inhabit (at least) three-dimensional space. But it is not obvious that you and I have *any* connected, extended parts in that space. One (wholly empirical) question is this: "Am I a fusion of countably many, properly arranged, point-sized particles?" If the answer turns out to be "yes", then no doubt my apparent three-dimensionality is a consequence of their exceedingly dense and careful arrangement, upon which depends all sorts of interesting properties. But if the answer should turn out to be "yes", then I am in fact (like any fusion of countably many point-sized items) a scattered zero-dimensional object! Or, perhaps, at some level of decomposition I have a one-dimensional, connected part (a string-like part), but no two-dimensional, connected parts. Then I am (despite appearances) a scattered one-dimensional thing. Or, I could be a scattered two-dimensional thing. You never know. Upon reflection, then, I conclude that no one in the receptacle debate can help himself to what I will call "the quick argument" for the existence (or even possible existence) of n -dimensional objects on the grounds that we know ourselves to be n -dimensional creatures. We don't.⁷

Second, a bit of stage-setting. In the discussion that follows, I intend to call upon two metaphysical positions identified as starting points in the Introduction (universalism and the pointy view of simples), as well as the relatively uncontroversial claim that space is neither granular nor

⁷ Perhaps it is worth remarking that we don't even know that we are not beings extended in four-dimensional space. Even the so-called Flatlanders who live on the surface of a sphere might (unbeknownst to them) have a tail that dips into the interior of the sphere.

gunky, but rather a continuum of spatial points.⁸ Accordingly, I am happy to let the main thesis of this chapter be read as a conditional: Assuming realism with respect to both points and regions in a non-discrete space, if the following two presuppositions are true, then (despite their popularity) neither the O-theory nor the C-theory nor the T-theory poses a genuine alternative to the liberal view of receptacles.

(Universalism): Necessarily, for any objects, the *x*s, there exists an object, *y*, such that the *x*s compose *y*.

(PV): Necessarily, *x* is a material simple if and only if *x* exactly occupies a point-sized region.

Now, thus equipped, let us join the battle.

§3 Against the O-theory

Choose some object, *O*. By hypothesis, *O* is open, and thus (at least) three-dimensional, since all two-, one-, and zero-dimensional objects are either closed or partially open.⁹ Now *O* has at least one (proper or improper) part, *P*, which exactly occupies a connected, non-point-sized region. Otherwise, *O* would be—contrary to hypothesis—a fusion of scattered, point-sized objects, and thus not itself open. So *P* is a three-dimensional object, exactly occupying an open, connected region. But since *P* is extended, *P* is not a material simple—by (PV)—and thus *P* has proper parts. Accordingly, we may expect some way of subdividing the region exactly occupied by *P* into the regions exactly occupied by *P*'s proper parts.

Problem! The open, connected region exactly occupied by *P* is not the union of any collection of non-empty, non-overlapping, open regions. At least one of *P*'s proper parts, then, is not open, and the

⁸ Well, I suppose this one is somewhat controversial, too, but less so. See Forrest 1995 and 1996.

⁹ For the record, if space is four-dimensional, then there are no open, three-dimensional objects at all, and the common sentence “*R* is an open sphere about *p*” would be a rather misleading one—cf. (D6) in the Introduction. Also, just to be clear, this opening move against the O-theory presupposes that the topological space at issue is a Hausdorff space.

O-theorist must reconsider his verdict against all non-open objects.¹⁰ But how shall he reconsider? Perhaps it will be helpful to note that there are at least two kinds of cuts that would be candidates for separating some of P's proper parts from one another.

Slicing cuts: Think of a slicing cut as one that separates parts of a three-dimensional object by cutting into one of its surfaces. (Separating a sphere into two hemispheres, for example, requires a slicing cut.)

Scooping cuts: Think of a scooping cut as one that separates parts of a three-dimensional object by scooping out some portion of its interior, but leaving its original surfaces intact. (Separating a sphere into a husk and a core, for example, requires a scooping cut.)

I acknowledge that we might need movement through a fourth spatial dimension or some fancy transporting device to make a scooping cut; but I don't really care about making any *actual* cuts—I care only about invoking the cutting metaphor as an intuitive way of focusing on certain parts of a given material object.

So, once again, at least one of P's proper parts is not open. Whether it is partially open or closed, however, depends on just what kinds of cuts would lay bare P's proper parts. One revision that our O-theorist might endorse at this juncture is the claim that every object that exactly occupies a connected region of space (as does our P) has parts that would be revealed only by slicing cuts. On that restriction, we would have (at least) a commitment to both open objects and to partially open objects. (The slicing cut that separates an open sphere into two hemispheres, for example, will leave at least one of the hemispheres partially open.) Alternatively, another revision that our O-theorist might explore at this juncture is the claim that every object that exactly occupies a connected region of space (as does our P) has parts that would be revealed only by scooping cuts. On that restriction, we would have (at least) a commitment to both open objects and to either closed or partially open objects. (The scooping cut that separates an open sphere

¹⁰ What of *overlapping*, open regions, though? The open, connected region exactly occupied by P is the union of a collection of non-empty, overlapping, open regions. One problem with this suggestion is that it leads to (an objectionable) theory according to which some talk about matter could not be analyzed in terms of talk about material objects; but since the general idea behind the current suggestion is sufficiently similar to a problem case raised for the T-theorist below, I shall reserve further discussion until later.

into a husk and a core, for example, will leave at least either the husk or the core closed or partially open.)

On either alternative, then, we have a mix, and the original O-theorist's thesis must be relinquished. Beginning with the O-theorist's thesis, inevitably we end up with either both open objects and partially open objects or with both open objects and either closed or partially open objects. But it gets better—for by invoking a simple recombination principle (of the kind discussed in the Introduction) we can reconfigure various objects in this mix so that they jointly exactly occupy open, closed, and partially open three-dimensional, connected regions of space. And finally, by way of universalism, we can then identify all manner of possible fusions that will guarantee not only the possibility of open objects, but also that of *both* closed and partially open ones as well.

§4 Against the C-theory

Begin by assuming that there are three-dimensional objects. (This assumption is for convenience of exposition only; you may take it back whenever you wish.) Now choose some three-dimensional object, *C*. By hypothesis, *C* is closed. Now *C* has at least one (proper or improper) part, *P**, which exactly occupies a connected, non-point-sized region. Otherwise, *C* would be—contrary to the hypothesis—a fusion of scattered, point-sized objects, and thus not itself three-dimensional. (Incidentally, if *C* were a fusion of scattered, point-sized objects, the liberal view of receptacles could be had straightaway from any one of its point-sized parts, together with universalism and a simple recombination principle.) So *P** is a three-, two-, or one-dimensional object, exactly occupying a closed, connected, non-point-sized region. But since *P** is extended, *P** is not a material simple—by (PV)—and thus *P** has proper parts. Accordingly, we may expect some way of subdividing the region exactly occupied by *P** into the regions exactly occupied by *P**'s proper parts.

Problem! Although the closed, connected region exactly occupied by *P** is indeed the union of some collection of non-empty, non-overlapping, closed regions, this occurs only when at least one of the regions in each such collection is either two-, one-, or zero-dimensional. The C-theorist can maintain her position, then, only if she grants that at

least one of P^* 's proper parts is not three-dimensional. Should she try to draw the line at two-dimensional, closed objects, however, the same line of reasoning will drive her to countenance one-dimensional, closed objects. Can she draw the line at one-dimensional, closed objects? Prospects are not promising. Any such object will be extended, and thus—by (PV)—will have proper parts. Consequently, if the C-theorist hopes to ban point-sized things (and thereby block the quick route to the liberal view of receptacles noted above), it would appear that she must reconsider her verdict against all non-closed objects. But how shall she reconsider?

Since she has already been driven to recognize one-dimensional objects, her only option is to accept partially open objects in addition to closed ones. (Since no one-dimensional object is open, granting open objects doesn't help.) But with tools consisting of universalism and a generous recombination principle and materials consisting of the possibility of closed and partially open objects, open objects can be regained.

Perhaps it is worth noting that another (quite different) case can also be mounted against the C-theory which requires only countably many, three-dimensional, closed objects—and their fusion. One need only arrange them properly. I will reserve the details of this case for the next chapter, where I will take up an investigation of the relation of perfect contact.

§5 Against the T-theory

Whereas the previous two theorists both tried (unsuccessfully) to demonstrate that the liberal view of receptacles was *too* liberal in maintaining that not all possible material objects have the same kind of surface, the T-theorist tries to show that the liberal view of receptacles is *too* liberal in maintaining that not all material objects are extended in the same number of dimensions.

The T-theorist, then, has no problem with our previous reasons for thinking that open, closed, and partially open objects are all possible, but as of yet he sees no reason to recognize any two-, one-, or zero-dimensional objects in addition to these. Even if he does not have recourse to the quick argument dismissed above, in his common-sense

way, he would like to avoid treating surfaces, edges, and corners of his everyday objects as genuine things themselves.

One final time, then, choose some three-dimensional object, *T*. (Of course, if there's not one to choose, since there are some material objects, the *T*-theorist loses immediately.) By hypothesis, *T* may be either open, closed, or partially open. Now *T* has at least one (proper or improper) part, *P***, which exactly occupies a connected, non-point-sized region. Otherwise, *T* would be—contrary to the hypothesis—a fusion of scattered, point-sized objects, and thus not itself three-dimensional. So, *P*** is a three-dimensional object, exactly occupying an open, closed, or partially open, connected region. But since *P*** is extended, *P*** is not a material simple—by (PV)—and thus *P*** has proper parts. Accordingly, we may expect some way of subdividing the region exactly occupied by *P*** into the regions exactly occupied by *P***'s proper parts.

Any *T*-theorist (who shuns arbitrariness) will need to accept some *principle* about just which subregions of the region exactly occupied by a material object contain proper parts of that object. But what would such a non-arbitrary principle look like? Suppose we make things difficult and take a very conservative stand on behalf of the *T*-theorist, maintaining that the subregions of a region exactly occupied by a material object that contain proper parts of that object are just its three-dimensional, connected subregions (whether they happen to be open, closed, or partially open). Unfortunately, even this conservative attempt will not do.

Consider a sphere (with any kind of surface you like) exactly occupying a connected region of space, herewith named 'Sphere'. One perfectly precise subregion of the region in question is all of that spherical region minus its center point. Our very restrictive principle above nevertheless declares that our sphere will have a proper part in that subregion, herewith named 'SphereMinus'. But the following general principle (herewith named the 'Remainder Principle') is certainly true:¹¹

(RP): Necessarily, for any material objects, *x* and *y*, if *x* has *y* as a part, and *y* does not have *x* as a part, then there exists a material object, *z*, such that *x* has *z* as a part, and *z* does not overlap *y*.¹²

¹¹ At least, *I* think it is certainly true. For a dissenting opinion see Gotts, Gooday, and Cohn 1996. One can, of course, simply deny (RP), but it's costly; for a discussion of the counter-intuitiveness of this way out see Varzi 1997.

¹² The Remainder Principle is simply the so-called Weak Supplementation Principle of mereology. For a rather formal discussion, see Simons 1987: 28. It might be thought

But Sphere has SphereMinus as a part, and SphereMinus does not have Sphere as a part. Consequently, Sphere has some other part that does not overlap SphereMinus. And where could that other part be located except at the only point-sized region where we find Sphere but not SphereMinus? In other words, even the conservative principle above will lead to a recognition of point-sized objects. (And remember: get yourself one point-sized object to work with, and a simple recombination principle together with universalism will then permit you to construct anything you like with it.)

But maybe we weren't conservative enough. Let us come to the rescue of the T-theorist by proposing that when a material object exactly occupies some region, r , then a subregion of r , namely, s , is exactly occupied by a part of that object if and only if s is a three-dimensional, connected region, *and* there is another three-dimensional, connected region, s^* , such that (i) s and s^* are non-overlapping, and (ii) r is the union of s and s^* . This more conservative policy avoids the SphereMinus case only to run headlong into its cousin. Accordingly, consider our friend Sphere once again. One perfectly precise subregion of the region exactly occupied by Sphere is the northern hemisphere minus the disc-shaped region whose perimeter is the sphere's equator. *That* region still qualifies. Call its occupant (who is now recognized as a part of Sphere) 'Northerner'. Another perfectly precise subregion of the region exactly occupied by Sphere is the southern hemisphere minus the disc-shaped region whose perimeter is the sphere's equator. That region meets our new restriction, too. Call its occupant (likewise a part of Sphere) 'Southerner'. But, by universalism, Northerner and Southerner have a fusion, herewith named 'Almost-A-Sphere'. Now we may make use of our Remainder Principle once again. Sphere has Almost-A-Sphere as a part, and Almost-A-Sphere does not have Sphere as a part. Consequently—by (RP)—Sphere has some other part that does not overlap Almost-A-Sphere. And where could that other part be located except at the only circular region where we find Sphere but not Almost-A-Sphere? In other words, even this more conservative policy will lead to recognition of two-dimensional objects (e.g., that disc whose perimeter is

that the Remainder Principle begs the question against the T-theorist, but the Remainder Principle is by itself consistent with the T-theory. It is only when it is combined with other background assumptions, such as the ban on extended simples and a principle of unrestricted fusions, that trouble ensues.

Sphere's equator and that separates the two halves of Almost-A-Sphere without overlapping it). Moreover, it is easy enough to see that the same strategy can be used to reintroduce one-dimensional poles and zero-dimensional grains. And once we've got those back, there'll be no stopping us.

Of course, even more draconian restrictions on those subregions are available, but in order to ensure that they do not fall victim to the kind of considerations just exploited, such restrictions appear in the end to be very artificial and arbitrary, indeed. Consequently, I suggest that the T-theorist's view is not quite the trouble-free position of common sense that it is so often made out to be.¹³

Admittedly, even if we have no quick argument for the existence (or even possible existence) of three-dimensional objects, and even if a serious suspicion has here been cast on the T-theorists, and even if the O-theorists and C-theorists have been refuted outright, these achievements certainly do not amount to a full-fledged *defense* of the liberal view of receptacles.¹⁴ Still, if these three rather prominent and intuitively plausible rivals are eliminated, the liberal view of receptacles should appear considerably more attractive than it may have at first glance.

¹³ Incidentally, if the T-theorist should turn out to be right, mereology may simply turn out to be a branch of topology, since if, necessarily, all material objects are three-dimensional, the alleged mereological primitive 'x is a part of y' can be given an analysis in terms of connectedness. For discussion of this proposal, see Casati and Varzi 1999: ch. 2.

¹⁴ Let me pause to mention Timothy Bays, however, who maintains that a direct argument for the liberal view of receptacles can be constructed from my starting points which dispenses almost entirely with the topological reflections I have emphasized here. See his 2003. Perhaps I should note that Bays assumes the Axiom of Choice in his primary argument and that he assumes the thesis of no co-location in defending his lemma. He does note the first of these assumptions, however.

3

Contact and Boundaries

§1 Three Analyses of ‘Touching’

With the liberal view of receptacles now motivated, I would like to examine how our beliefs about receptacles can inform our analysis concerning the relation of being in perfect contact.

Whether we are willing to assent to sentences of the form ‘this object touched that object’ often depends on the context—in particular, it often depends on what level of precision we employ in fixing the boundaries of the objects in question. Compare our use of the term ‘flat’. We tend to have one standard in mind when declaring that a Kansas wheat field is flat, another when we agree about the flatness of the top of a billiard table, and yet another when we talk about a mandelbrot set. Similarly, we tolerate quite crude, perceptually based standards when we say something such as “The hand touches the desk”, but set the bar much higher when we say something such as “The open sphere touches the closed cube”. Throughout the present chapter, I intend to use the term ‘touching’ (and its cognates) synonymously with ‘being in perfect contact’, a pair of phrases I will use to denote the relation which corresponds to the very highest standards for judgment about such matters.

Well, what is that standard? Suppose we begin with the plausible suggestion that touching is simply a matter of sharing a boundary point, (as does Cartwright 1987: 172), together with the proviso that an object x is credited with touching an object y whenever one of x ’s parts touches one of y ’s parts. (After all, touching something does not require touching each of its parts!) In other words, x might touch y even though x and y do not share a boundary point, provided that some part of x shares a boundary point with some part of y .¹ This suggestion yields

¹ This may happen, for example, when the relevant parts of x and y are located deep in x ’s interior. More generally, let us note that not every boundary point of a part of x is automatically a boundary point of x .

(C1): Necessarily, x touches y if and only if $\exists r_1, \exists r_2, \exists w, \exists v, \exists p$ (i) w is a part of x , whereas v is a part of y ; (ii) w exactly occupies r_1 , whereas v exactly occupies r_2 ; and (iii) p is a boundary point of both r_1 and r_2 .

According to (C1), then, a perfectly good way for two open objects to touch is to be somewhere separated only by a point that falls between them, for such a scenario will ensure a boundary point common to each. (Imagine, for instance, two open spheres separated by an unoccupied plane that intersects the closure of each at exactly one and the same point-sized region.) Likewise, an open object will touch a closed one when some pair of their respective parts are so positioned that there is no unoccupied space between them, for some outermost point in the region exactly occupied by the relevant part of the closed object will be a boundary point common to each of the parts in question. (Imagine, for instance, an open cube that is limited on one surface by the surface of a closed cube of the same size.) Furthermore, no two (non-overlapping) closed objects will touch no matter how they happen to be positioned, for it would seem that only by way of overlap can two closed objects be so arranged as to guarantee that a part of each shares a boundary point with a part of the other. (Imagine, for instance, two closed hemispheres which overlap by sharing the two-dimensional disc whose perimeter is the equator of their host sphere. The northern hemisphere, as we may call it, will touch the southern hemisphere, in virtue of one of its partially open, proper parts—namely, “all of the northern hemisphere minus the disc”—which certainly seems to be in perfect contact with the southern hemisphere.)

Whether or not (C1) strikes one as plausible, however, should turn on just what regions one takes to be receptacles. As I argued in Chapter 2, I think that any region (save the null region, should we wish to acknowledge that) is a receptacle. Moreover, given my adherence to universalism, I also think that for any two regions that are (respectively) exactly occupied by two material objects, there is another material object that exactly occupies the union of the two regions. Furthermore, given my adherence to the doctrine of arbitrary undetached parts, I also think that any material object that exactly occupies a region is such that for any subregion of that region, that material object has a part that exactly occupies that subregion. Others disagree. Cartwright, for instance, thinks that no point-sized region is a receptacle, that no region

with finite membership is a receptacle, that no region with countable membership is a receptacle, and that no line, curve, or surface is a receptacle, either. Whereas that collection of intuitions happens to be rather widely endorsed, Cartwright himself proves to be far more restrictive than this when he announces that every receptacle is an open region (1987: 172). Rather than reentering disputes over just which regions are receptacles, however, at the moment I simply want to highlight the relevance of these disputes to questions about touching.

Let me make my point first with Cartwright's restrictive view. If one believed (as he does) that only open regions are receptacles, then one should be wholly satisfied with (C1). Why? Because on that view it is not possible that two objects be any closer than are two open objects exactly occupying regions that share a boundary point, and because it would seem that two objects could not have a better claim to being in perfect contact than by being as close as it is possible for two objects to be.² I here ignore the case of overlapping open objects. Although there is some temptation to say that such overlappers would be even closer still in virtue of being partly in the same region, this particular kind of overlap is significantly dissimilar from that of the closed, northern and southern hemispheres above. Recall that our current hypothesis declares all objects open, and note that any open part (confined to one overlapper) would be entirely *separated* from any open part shared by the overlappers. Consequently, overlap is not by itself sufficient for the kind of closeness we have in mind when speaking of perfect contact.

But what should someone believe who agrees with me that points, lines, curves, and surfaces are all perfectly respectable receptacles, and that any union of respectable receptacles is a respectable receptacle? It is interesting to note that we can all begin with the same general methodological strategy apparently employed by Cartwright: namely, to let our highest standards for touching require whatever relation is such that (i) it is possibly instantiated, and (ii) whenever two objects stand in that relation, it is not even possible that any two objects be more deserving of the description 'in perfect contact' than they.

² Let me note, however, that by invoking closeness (as with definitions (D1)–(D10) in the Introduction), I will once again be working with a mixture of topological and metrical notions.

But it would seem that on this rather liberal view of receptacles no two (non-overlapping) open objects can any longer serve as examples of being in perfect contact, since it is clearly possible for two objects to be more deserving of that description than they. Consider again our two open spheres separated by an unoccupied plane that intersects the closure of each at exactly one and the same point-sized region. If we believe that two-dimensional regions are receptacles, then we can fill the portion of that unoccupied plane that separates our two spheres with a type of material object that we might call a “plane-wall”. Admittedly, in one sense it is not possible for any two objects to get any *closer* to one another than are our spheres, for on the standard way of determining closeness (i.e., the minimal distance between their closures), their distance is zero. Nevertheless, our two spheres are not among those objects most deserving of the description ‘in perfect contact’, since (without changing their positions with respect to one another) they may be separated by a third material object that overlaps neither of them!

But if not two (non-overlapping) open objects, what will count on the liberal view as an example of some objects that are among the most deserving of the description ‘in perfect contact’? Consider again an open cube that is limited on one surface by the surface of a closed cube of the same size. These two objects seem to do the trick. Of course, they are similar to the two open objects insofar as they share a boundary point; but they are significantly dissimilar insofar as no plane-wall can come between them without overlap. The formal difference is that (unlike the two spheres) the two cubes share a boundary point that is itself a member of one of the regions exactly occupied by one of the cubes. Perhaps, then, a proponent of the liberal view of receptacles should maintain that touching is not simply a matter of having parts that share a boundary point; rather, it is a matter of having parts that share a boundary point which, in turn, is a member of a region exactly occupied by one of the parts in question. This suggestion yields

(C2): Necessarily, x touches y if and only if $\exists r_1, \exists r_2, \exists w, \exists v, \exists p$ (i) w is a part of x , whereas v is a part of y ; (ii) w exactly occupies r_1 , whereas v exactly occupies r_2 ; (iii) p is a boundary point of both r_1 and r_2 ; and (iv) p is a member of at least one of r_1 and r_2 .

A proponent of (C2) will thus declare that an open object and a closed object can be more deserving of the description ‘in perfect

contact' than can any pair of (non-overlapping) open objects, which could always be separated by something like a plane-wall. Unfortunately, (C2) is subject to a quick (but devastating) counterexample. (C2) entails the silly consequence that any point-sized object touches itself merely in virtue of occupying whatever region it exactly occupies, a region that (of course) has the same boundary point as itself. (Note that any point-sized object, S , will be fit to serve as both w and v —since it will be an improper part of itself—thereby ensuring that $r_1=r_2$.) Understandably, that consequence need not trouble anyone who doesn't believe in point-sized objects to begin with, but it should certainly seem an undesirable feature of the analysis to those who were attracted to it precisely because they held the liberal view of receptacles, a view which recognizes the possibility of point-sized objects. Perhaps, though, the intuition that touching always relates at least two distinct things need not require us to give up on the main idea inspired by the liberal view of receptacles. Let us just supplement the current analysis by requiring that at least one of the relevant regions be both connected and non-point-sized.³ This suggestion yields

(C3): Necessarily, x touches y if and only if $\exists r_1, \exists r_2, \exists w, \exists v, \exists p$ (i) w is a part of x , whereas v is a part of y ; (ii) w exactly occupies r_1 , whereas v exactly occupies r_2 ; (iii) p is a boundary point of both r_1 and r_2 ; (iv) p is a member of at least one of r_1 and r_2 ; and (v) at least one of r_1 and r_2 is a (non-point-sized) connected region.

Now, we seem to have all the advantages of (C2) without the silly and immodest consequence that all point-sized objects touch themselves at each of the moments that they exist just by being somewhere or other.

§2 Grainy Objects and Neighbors

For quite some time I counted myself among the proponents of (C3)—until I realized that the proponent of (C3) faces a very curious puzzle,

³ Why say *both* 'connected' and 'non-point-sized'? Because there is a perfectly good sense in which a region with exactly two elements is non-point-sized, yet also not connected. (This is also the sense in which an object can count as "bigger than point-sized", yet not have extension; e.g., when it is the scattered fusion of two point-sized things.)

indeed. To entertain this puzzle properly, let us introduce some new terminology.

First, let us say that an object is *grainy* if and only if it exactly occupies a region, all of whose non-point-sized subregions are disconnected. Note that any object which exactly occupies a region that has a finite number of members is grainy, and that any object which exactly occupies a region that has a countable infinity of members is grainy. Being non-grainy, then, requires exactly occupying a region that has an uncountable infinity of members. Accordingly, let us acknowledge that any point-sized object is grainy, and that any fusion of countably many point-sized objects is grainy, as well. Second, let us say that two objects are *neighbors* if and only if the first exactly occupies a region that is not separated from the region exactly occupied by the second, and that these two regions have a null intersection.

Now, upon reflection on the notions of graininess and being neighbors, I suspect that a very common reaction is to assume that no two (non-overlapping) grainy objects touch—perhaps because it seems obvious that any grainy object is closed, and because no two (non-overlapping) closed objects touch. And I suspect that another very common reaction is to assume that any two neighbors touch, for two such objects will always have parts that share a boundary point, which, in turn, is a member of one of the regions exactly occupied by one of the parts in question. Initially, we might even feel confident enough about these common reactions to regard them as adequacy conditions on our attempts to formulate a proper analysis of touching. However (quite surprisingly), we will soon see that we have to choose between this pair of powerful intuitions, for there are clear-cut cases where they come apart.

Let ‘A’ and ‘B’ name two point-sized objects that are in an otherwise unoccupied room. At 1:30, point-sized object C is inserted halfway between A and B on the line described by the point-sized regions exactly occupied by A and B. At 1:45, D is inserted halfway between A and C. At 1:52:30, E is inserted halfway between A and D. At 1:56:15, F is inserted halfway between A and E. Zeno the series!⁴

⁴ I am informed that some do not approve of the verb ‘to Zeno’, but I enthusiastically recommend it!

Let 'Bits' name the fusion of all of the point-sized objects (excepting A) which are in the room at 2:00. Bits has a (countable) infinity of point-sized parts, each of which exactly occupies a point-sized region on a segment of a particular line that runs through the room. Bits, in turn, exactly occupies that scattered region which is the union of all of those point-sized regions. Thus, Bits is a grainy object. Owing to its lack of any non-point-sized subregions, A is a grainy object, as well. Clearly, A and Bits do not overlap.

So A and Bits are two (non-overlapping) grainy objects. Thus, if we adhered to the first common reaction reported above, we would be forced to claim that A and Bits do not touch.

Recall now that A exactly occupies a point-sized region, which (as is true of any point-sized region) has its only member as its only boundary point. But then (given our previous description of Bits) we can see that the point-sized region exactly occupied by A contains a boundary point both of itself and of the region exactly occupied by Bits. It then follows that the intersection of the closure of the region exactly occupied by Bits with the region exactly occupied by A is not null. Accordingly, A exactly occupies a region that neither overlaps nor is separated from the region exactly occupied by Bits.

So, A and Bits are neighbors. Thus, if we adhered to the second common reaction reported above, we would be forced to claim that A and Bits do touch, after all.

We can't have it both ways! Which common reaction shall we abandon to the misleading intuitions pile? Well, if our intuitions are in conflict, perhaps it is best to consult our current analysis (which, after all, does have something going for it) for some guidance. Significantly, (C3) yields the result that A and Bits do not touch, for A and Bits fail to satisfy condition (v)—i.e., neither of our grainy objects has a part that exactly occupies a (non-point-sized) connected region of space. On this resolution of our conflict, then, it turns out that some neighbors don't touch, and *that* is an exceedingly odd consequence to be stuck with. But something has to go; perhaps we should just bite the bullet.

I fear that biting the bullet won't do. There are objects whose prospects for touching Bits should be just as good or as bad as are those of our object A. Allow me to introduce one. Consider a one-dimensional material object, line-segment-shaped, with a closed interval at exactly one end, herewith named 'Connected'. Now, remove A from

the room containing Bits and carefully place Connected in the room so that all of its parts fall on the same line where we find all of the parts of Bits, so that the closed end of Connected now exactly occupies the point-sized region recently vacated by A.

Clearly, that point-sized region will now contain a common boundary point of the regions exactly occupied by Connected and Bits, and that boundary point will also be a member of the region exactly occupied by Connected itself. To this extent, then, Connected and Bits resemble A and Bits; each pair is an example of two objects that are as close as it is possible for two objects to be. The only interesting difference between the two pairs seems to depend entirely on a superfluous part of Connected, a part that doesn't seem to be relevant to whether or not Connected touches Bits. This particular part (which we might call Connected's tail) is thoroughly *separated* from Bits by a unique point-sized part of Connected—that is, by a part that exactly occupies the only region which contains a boundary point of Bits without also containing a member of the region exactly occupied by Bits. Of course, that apparently *relevant* feature was also a characteristic of our object A, and how could A's not having a tail (which would be wholly separated from Bits by A itself) be relevant to whether A touches Bits? Accordingly, one expects the same verdict about whether touching occurs between the two objects in each pair. Suspiciously, though, (C3)—contrary to expectation—yields the result that Connected and Bits touch. For unlike the case of A and Bits, one of the objects in our new pairing guarantees that condition (v) is satisfied, after all. Whatever the correct analysis of touching turns out to be, it should generate the same answer to the question “Does A touch Bits?” as it does to the question “Does Connected touch Bits?” So much the worse for (C3).

§3 Two More Analyses of ‘Touching’

Perhaps, then, we should aim for a revision of (C3) that won't force us to split our vote on the two cases by way of guaranteeing that neither A nor Connected touches Bits. This suggestion yields

(C4): Necessarily, x touches y if and only if $\exists r_1, \exists r_2, \exists w, \exists v, \exists p$ (i) w is a part of x , whereas v is a part of y ; (ii) w exactly occupies r_1 , whereas v

exactly occupies r_2 ; (iii) p is a boundary point of both r_1 and r_2 ; (iv) p is a member of at least one of r_1 and r_2 ; and (v) both r_1 and r_2 are (non-point-sized) connected regions.

A new problem grounded in point-sized objects now arises. Earlier we argued against (C2) that it entailed that any point-sized object touches itself. (C4) certainly doesn't have that unwanted entailment, but along with its effective ban on (certain kinds of) self-touching, (C4) has also managed to rule out any and all touching of point-sized objects. For a proponent of the liberal view of receptacles, this isn't credible. A point-sized object that exactly occupies the center point of a sphere is clearly touched by a great number of objects (including the object which is that sphere minus the object at its center point). What we need, then, is an analysis that doesn't entail that every point-sized object touches itself, but which permits the touching of a point-sized object by other objects of the right size, shape, and surface.

Such a strategy will inevitably encourage us to resolve the tension between our common reactions concerning grainy objects and neighbors by reversing our former solution. Thus, we will be able to retain the extremely plausible claim that any two neighbors touch (including Connected and Bits, as well as A and Bits). The price we pay this time around is acknowledging that some pairs of (non-overlapping) grainy objects can touch one another, after all! Perhaps, though, this pill will be easier to swallow once we recognize that our previous motivation for denying that any (non-overlapping) grainy objects touch one another may well have been the *mistaken* view that every grainy object is closed. For, as we have seen, Bits exactly occupies a region which contains some but not all of its boundary points, and thus qualifies as partially open. The cost of our new strategy for regaining consistency, then, is not so exorbitant as to force us to grant that two (non-overlapping) closed objects can touch. This suggestion yields

(C5): Necessarily, x touches y if and only if $\exists r_1, \exists r_2, \exists w, \exists v, \exists p$ (i) w is a part of x , whereas v is a part of y ; (ii) w exactly occupies r_1 , whereas v exactly occupies r_2 ; (iii) p is a boundary point of both r_1 and r_2 ; (iv) p is a member of exactly one of r_1 and r_2 ; and (v) $w \neq v$.

By way of a quick review of our previous counterexamples to its predecessors, let us note that (C5) permits one to say that Connected touches Bits, that A touches Bits, that whereas point-sized objects never

touch themselves, they nevertheless can be touched by other objects, and finally that there is no touching between any two (non-overlapping) open objects, since something like a plane-wall could always come between them (without overlap and without changing their positions with respect to one another).⁵

Initially, (C5) appears to have some peculiar consequences of its own. Recall from the Introduction that a material simple is a material object with no proper parts, and that I took the pointy view of simples as a starting point:

(PV): Necessarily, x is a material simple if and only if x exactly occupies a point-sized region.

Of course this is debatable, and whether a material simple could exactly occupy an extended region is currently a controversial question. However, (C5) seems to rule out the possibility of certain kinds of extended material simples. Here's why. Suppose that there is a (partially open) extended material simple, say a spatially connected object, shaped like a snake, in an otherwise unoccupied room. Once we grant the existence of an object like that, however, it would seem that there would be no reason to suppose that it couldn't coil up head to tail, as it were, and touch itself. Perhaps (as a connected spatial object) it would have to become a little thinner here and there to change from snake-shape to donut-shape, but certainly (one might think) we would have to regard its movement as a clear instance of self-touching. This concession, though, would prove fatal to (C5), for (C5) requires that all touching (even self-touching) involve two distinct parts in virtue of which the touching occurs. The snake-simple, as I will call it, would violate this condition owing to its utter lack of proper parts. Thus, it would seem reasonable to conclude that if (C5) is true, then it is not possible that there be such extended material simples.

Despite initial appearances, (C5) is innocent of such charges. Although I originally regarded (C5) guilty as charged (but didn't care about the crime), the case for the defense was compellingly presented by Michael Bergmann in correspondence, and since he's right, it's worth showing that (C5) is innocent for those who do not share my endorse-

⁵ Thanks to Shieva Kleinschmidt for persuading me that clause (iv) in (C5) should read 'exactly one of' as opposed to 'at least one of' to avoid misclassifying certain cases of mere overlap.

ment of (PV) and thus who may care about the crime. Here's the resolution. The temptation to say that the snake-simple touches itself arises only when we move from thinking of touching as a description of an instantaneous state to thinking of it as a description of a temporally extended event. Consider each of the moments during which the snake-simple changes from snake-shape to torus-shape. At no moment in the sequence are we compelled to say that the snake-simple is in a state of self-touching, for at some of the moments there is a spatial gap between its head and its tail, while at other moments it simply exactly occupies a torus-shaped region of space without any parts exactly occupying any subregions of that region.

§4 Bits and Pieces

Lest you think there is no controversy to be had, however, here is a genuine consequence of (C5) that will lead others to resist it in favor of some competing analysis. Recall our protagonists, A and Bits, and recall that our present analysis yields the verdict that they touch. Here is another character we may introduce into the story—Pieces. Pieces is (like Bits) a scattered material object. Pieces is (like Bits) both grainy and partially open. Pieces has (like Bits) the member of the region exactly occupied by A as its only boundary point which is not also a member of the region it exactly occupies. And finally, all of the parts of Pieces lie on exactly the same line as do all of the parts of Bits. Here's the surprise: Pieces lies entirely between A and the outermost point-sized part of Bits (i.e., that point-sized object we earlier named 'B'). In other words, the outermost part of Pieces lies halfway between the outermost part of Bits and the second-outermost part of Bits, while the second-outermost part of Pieces lies halfway between the second-outermost part of Bits and the third-outermost part of Bits, and so on.

(C5) yields the result that *both* Bits and Pieces touch A! Surely, we want to balk at this. Doesn't Bits get in the way of Pieces touching A? And doesn't Pieces get in the way of Bits touching A? After all, for every point-sized part of Pieces, there is an infinity of point-sized parts of Bits closer to A than it, and for every point-sized part of Bits, there is an infinity of point-sized parts of Pieces closer to A than it—and they all fall on the same line! Nevertheless, it is true that you can't so much as

slip a point-sized object between (the composite object) Bits and A or between (the composite object) Pieces and A. And when you can't do *that* for objects of this sort, I say they touch. The consequence is surprising—but it's a result not a *reductio*.

So, as one who can think of no other candidate analysis more plausible than the five we have already seen, as one committed to the liberal view of receptacles, and as one wholly opposed to some (but not all) kinds of self-touching, I recommend (C5) to the reader.

§5 Some Reflections on Boundaries

All this talk of contact invites a general discussion of boundaries. I am a realist about boundaries. Perhaps, were I more sympathetic to a notion of a gunky space or to a restriction on receptacles that leaves us with only open material objects, I might be more inclined towards eliminativism. But on the strength of the reasons given above against those enticements, realism it is.⁶ So just what is it I am confessing realism about?

On one very natural way of thinking of the matter, the boundary of a material object is just the region which is the set of all and only its boundary points (and I'm a realist about the regions).⁷ On this first conception, it matters not at all whether the points in the boundary fall within the extension of some object or other. Moreover, on this conception the only kind of material object that would lack a boundary would be a material object with no boundary points at all (e.g., a material object that exactly occupied all of space). One could, of course, debate whether every material object extends into its own boundary, but this would not be a debate about whether or not it had a boundary.

There is a more robust conception available, however. Another manner of thinking about the matter that has particular appeal to me

⁶ Those who are attracted to such views should nevertheless consult Varzi 1997 and Casati and Varzi 1999: ch. 5 before opting for an eliminativist view, for going “boundary-free” (as it were) may not end up solving the traditional puzzles that it might appear to solve at first glance.

⁷ For the sake of convenience I will continue to utilize the loose conventions of identifying regions with sets of points and of sliding back and forth between speaking of a point of space and of its singleton (i.e., the associated point-sized region).

(especially given the views introduced and developed thus far, including the (C5) analysis of contact, the liberal view of receptacles, the pointy view of simples, the doctrine of arbitrary undetached parts, and universalism) is the following:

(B): Necessarily, (x is a material boundary of material object y if and only if x is a material object that exactly occupies a region which is a set of boundary points of y).

A *complete* material boundary of a material object y exactly occupies a region which is the set of all and only the boundary points of y , while the *partial* material boundaries of y exactly occupy proper subregions of the region which would be exactly occupied by its complete boundary. Accordingly, where there is a closed sphere in three-space, there is a sphereshell—a two-dimensional material object that bounds the sphere. Where there is a two-dimensional disc in three-space, there is a ring of material point-sized bits on its perimeter that serves as one of its salient partial boundaries.

This mode of realism about boundaries—a realism made available by my preferred metaphysics (i.e., that boundaries of material objects are themselves material objects with restricted locations)—parts company with other prominent versions of realism in a number of ways. We may begin by taking issue with the second-class ontological citizenship traditionally afforded to boundaries.

First, consider the Aristotelian suggestion that a boundary is a dependent particular, owing its very being to functioning as a boundary of something or other distinct from itself or (even worse) being modally enslaved to whatever *actual* object it bounds (see Brentano 1988 and Chisholm 1984 and 1994). But once we recognize its genuine material status, there is no reason to deny that some two-dimensional tile which happens to be a face of a closed cube might have existed even if its complement in the cube did not. Indeed (theistic reasons aside) it is not clear why it could not have been the only material object in existence or could not have occupied all of space in some possible world with a suitably small manifold. A closed brick can survive the loss of its surface, and the surface can survive the loss of its interior brick; to maintain otherwise is to posit necessary connections between numerically distinct material objects that do not so much as overlap. We need better reasons

than this to contravene Hume's razor—"don't multiply necessities beyond necessity!"⁸

Second, consider the almost universal assumption that a boundary is always of a smaller dimension than its host. This intuition is rooted, I suspect, in thinking too narrowly about the boundaries of the objects in our thought-experiments. So, "Where is the boundary of a triangle?"—look to its three sides. And, "Where is the boundary of a two-dimensional disc?"—round its perimeter. And, "Where is the boundary of a one-dimensional pole?"—its two scattered end bits. But whereas those may be the most salient partial boundaries, they aren't the complete boundaries of these objects (at least not if the objects are embedded in three-space). Any point in the center of the triangle, disc, or pole is likewise a boundary point of that object, for every open area about such a point has a non-null intersection with both the object and its complement. As it turns out, the two-dimensional disc is its own complete boundary (and thus, unsurprisingly, has the same dimensionality as its host). Furthermore, (and perhaps somewhat surprisingly) any closed and less than n -dimensional object in an n -dimensional space will be its own complete boundary, while any partially open and less than n -dimensional object in an n -dimensional space will be one of its own partial boundaries. Extrapolating from our investigation of touching above gives us another way of seeing what is wrong with the diminished dimensionality requirement on boundaries. Recall the story of A and Bits. This time, however, start with a two-dimensional, one-square-inch tile, named 'B-tile', and put its center point on the point recently occupied by B in our story of A and Bits, making sure that the line along which Bits was distributed intersects B-tile at right angles. Then take another two-dimensional, one-square-inch tile, 'C-tile', and put its center point on the point recently occupied by C in our story of A and Bits, making sure that it remains parallel to B-tile. Follow suit with D-tile and E-tile and their brethren until you reach the series. Finally, put A-tile just where you would expect it to be (parallel to the rest with its center point on the point recently occupied by A in our story of A and Bits). Let us name the fusion of all the tiles 'Column'. Now, A-tile is a boundary of Column (and even an outer boundary of sorts), but it is

⁸ I was introduced to this delightful phrase and its clever title by Daniel Nolan (who credits Peter Forrest).

as robustly two-dimensional as is the host it serves, for despite having a countable infinity of tiles as parts, Column is no more than two-dimensional itself.

Of course, thus understood, such material boundaries could be large or small, connected or scattered, parts of their hosts or parts of their hosts' neighbors. And in this last remark lies a genuine difficulty for the realist. Achille Varzi has identified four different ways in which realists might take boundaries to relate to those objects they serve, acknowledging that the task of finding a principled way to decide between the alternatives has generated much of the literature on how to conceive of boundaries. In short, if two objects share a boundary, then either the common boundary belongs to neither, or it belongs to exactly one, or it belongs to both, or there are two co-located boundaries, one for each (Varzi 2004).⁹ Varzi maintains that these are mutually exclusive theories, but this should not be taken to mean that one must maintain that the sharing of boundaries always conforms to the very same one of these descriptions, for as we will now see, the proposal about material boundaries proffered above permits instances of the first three options (and does so without the dialethism that threatens to accompany the third).

For purposes of illustration, consider two aptly named objects—Pyramid and Cube. Each is a connected object, and Pyramid seems to be resting on top of Cube. Does Pyramid touch Cube? Well, not if repulsive forces keep them apart (as would happen in the actual world); but setting aside this complication, on the strength of (C5) we will say that they touch only if one is closed and the other open at a candidate region of contact. Consider three cases.

Case 1: Pyramid is open, Cube is open, and there is a closed two-dimensional tile between them such that Pyramid touches the tile and the tile touches Cube. In this case, the relevant portion of the tile is a common material boundary of both Pyramid and Cube—it separates Pyramid from Cube—and yet it does not belong to either of our solids. Note that this does not mean that somehow Pyramid touches Cube after all, but rather only that two material objects can share the same material

⁹ The first option Varzi assigns to Leonardo da Vinci 1938 and Sorensen 1986, the second to Casati and Varzi 1999, inspired by Bolzano 1950, the third to no one in particular (together with the warning that it may require affirming (p and $\neg p$)), and the fourth to Brentano 1988 and Chisholm 1984.

boundary without its being a part of either and without their being in contact.

Case 2: Pyramid is closed, Cube is open, and Pyramid and Cube are in contact. In this case, the doctrine of arbitrary undetached parts yields the verdict that there is a two-dimensional tile located on the bottom of Pyramid, and it is clear that this tile is a material boundary common to both Pyramid and Cube. Yet this tile is a part of Pyramid and not a part of Cube. Here, then, we have two material objects that share the same material boundary, which belongs to exactly one of them. (And pyramids aren't special—it could have been Cube that was closed and owned the joint boundary instead.)

Case 3: Pyramid is closed, Cube is closed, and Pyramid and Cube overlap by sharing a single two-dimensional tile. Pyramid and Cube touch one another, to be sure, but not in virtue of their common tile; rather, Pyramid touches Cube in virtue of its proper part which is “all of Pyramid save its lowermost tile”. This case, then, provides us with an example of two objects in contact that share a material boundary which happens to be a common part of each.

I have no fourth case to accommodate the Brentano–Chisholm contention that each has a distinct boundary co-located with the other, for the simple reason that the boundaries in question are here taken to be material substances, and I have endorsed the ban on such co-location in the Introduction. For what it's worth, the excuse that co-location should be tolerated when the coincident entities do not take up any volume and when the alleged coincidence doesn't involve any increase in mass doesn't soften my resolve; if co-location were really possible for such minor entities, then either universalism or the pointy view of simples would be forfeit (since there could then be a fusion of two co-located grains that would be point-sized and composite), and both universalism and the pointy view of simples are better defended (or so it seems to me) than is the relevant thesis of co-location for minima.

Still, insofar as I am willing to countenance instances of the sort reported in Case 2 above, the account of material boundaries I favor appears fully vulnerable to Brentano's critique of Bolzano's view—of being “a monstrous doctrine” according to which some material objects have boundaries while others suffer as impoverished, boundary-free entities (Brentano 1988). A word of defense, however: let us remember that (i) each such object still has a boundary of the first kind (i.e., a

unique region which is the set of all and only its boundary points); (ii) we must already learn to live with this consequence as soon as we have rejected a Whiteheadian theory of space and adopted the liberal view of receptacles; and (iii) the dissatisfaction motivating the epithet of monstrosity often seems to be rooted in little more than a vague discomfort about violating the Principle of Sufficient Reason (PSR)—a principle which is demonstrably false.¹⁰

More on the monstrosity. Pretend, if you will, that ink blots are connected as are the sheets on which they appear. Peirce (1893) asks: Which gets the boundary when a white paper is marked with a black spot—the spot or the background? It would appear that we have no non-arbitrary way of answering. Each is a viable candidate—why affirm an artificial privilege? Well, we could go with our intuitions which speak (I would suspect) in favor of the spot. But it's not at all clear to me that this is a plausible way to proceed, for I don't see any reasons to think that our intuitions would be truth-guiding in these matters. Moreover, given the perplexing but apparently widely shared view that having one's own boundary is a valuable feature, together with our tendency to privilege those entities we manage to notice and care about, I do see reasons to think that we might let our relatively narrow interests drive our judgments about which items may properly boast of owning their own boundaries. However, in admitting ignorance of boundary ownership, we need not acquiesce to the critique of embracing arbitrariness. Not knowing who possesses the boundary is not tantamount to not knowing what it takes to possess the boundary. Indeed, I think we would do well to heed a bit of advice offered by Varzi:

By the same token, we can say that every instance of Peirce's puzzle (and of its temporal analogues) is truly problematic and yet extrinsic to our concerns. Give me a theory of black spots, and make sure to tell me who gets the boundary—the spot or the background. Give me a theory of events, and make sure to tell me which gets the boundary—the movement or the rest. If we accept this response [according to which boundaries are assigned by theories other than the general theory of boundaries itself], we have a way of disposing of the puzzle in its general form. (Varzi 1997: 44–5)

¹⁰ See, e.g., the discussions in Smith 1997: 534 and Varzi 1997: 29, 44. A note on PSR: I say it is demonstrably false, but I am willing to acknowledge that there are *very expensive* ways of keeping it around. See my 1999 and 1997.

The only additions I would like to offer to this excellent advice are (i) that we pause to entertain mixed theories that assign the boundary sometimes to the spot or event and sometimes to its complement, depending on a variety of factors in play (e.g., the details of the causal story of its coming into existence); (ii) that we not impose as an adequacy condition on the proposed theories any guarantee that we will be in an epistemic position to determine whether the relevant conditions are satisfied—we simply may not have access to information about whether some given material item manifests what the theory requires of self-boundaried things; and finally (iii) that we stay on our guard against theories that would merely *stipulate* boundary possession—whereas the powers of stipulation may help us direct our attention in various ways, they cannot induce any relations of parthood among those objects to which we manage to refer.

Here is an example of the advice at work. Suppose that indeterminate existence is impossible and that time is continuous, and thus, that for any moment and any material object, the object either definitely exists at that moment or definitely fails to exist at that moment. Here's a mystery: are material objects the sort of thing that have a last moment of existence, but no first moment of non-existence (let's call such things that include their own later temporal boundaries 'Terminators'), or are they the sort of thing that have no last moment of existence, but a first moment of non-existence (let's call such things that lack their own later temporal boundaries 'Lingerers'), or are there some of each? Well, either (i) material objects are cross-temporal fusions of infinitely many momentary slices, or else (ii) material objects are cross-temporal fusions of finitely many momentary slices. If the latter, then material objects are, one and all, Terminators. If the former, then material objects are sometimes Terminators and sometimes Lingerers (the split being justified by the theory of four-dimensionalism and its commitment to the materiality of proper temporal parts). Of course, show me your favorite material object, and I'll be hard pressed to identify its proper classification—but not to the embarrassment of any theory about temporal boundaries.

Other intriguing issues involving boundaries remain.

Borders

Brody is a black Labrador—beautiful, strong, and solid. Or at least, she appears to be solid. But, as we now know, there is less to Brody (and to each of us) than appears to meet the eye. At each moment she is present, Brody is composed of some 10^{28} or more tiny material objects, swarming about in a very predictable storm of activity which (despite losing and gaining frightfully large numbers of members now and again) sustains a remarkably constant overall pattern. Strictly speaking, Brody is not a solid, and (as we saw in Chapter 2) her proper dimensionality is up for grabs as well, since it is consistent with our crude perceptual experience that she is anything from a zero-dimensional to a four-dimensional (or higher) entity. What is Brody's boundary? On the basic conception, it is just the region that is the set of all and only the boundary points of the region she exactly occupies—perhaps just a scattered region all of whose non-point-sized subregions are disconnected, or perhaps just a scattered collection of little sphereshell-shaped regions, or perhaps something even less familiar still. On the conception of material boundaries (if she has any), it is just the unique material thing that is the fusion of all the point-sized material objects located at those boundary points. But “No”, cries common sense. “That’s not how we think of Brody’s boundary. Brody is shaped like a dog, and those things just aren’t!” We might respond, of course, that, strictly speaking, that’s exactly how dogs are shaped and bet our money that there won’t be any solid canines out there to prove us wrong. But let’s give a little. Let’s agree that when Brody eats one of her plush toys (and before any of its parts become her parts), there is a perfectly good sense in which it is safely enclosed within her boundary. But the sense of ‘boundary’ which makes this true is clearly distinct from the senses we have explored thus far. Let’s denote such boundaries by the term ‘border’ and call the area enclosed by a border the ‘protected zone’. Now were there to be a solid filling Brody’s protected zone that had its own material boundary on her border, that thing would be shaped just the way we naively think the dogs of our world are shaped. Accordingly, one intriguing puzzle (further reflection on which I leave for another occasion) would be to

give a recipe for identifying the border of any given material thing once you have been given the location of its boundary points.

Vague objects

As noted in the Introduction, I am opposed to ontological vagueness. I side with the majority in thinking that some semantic account of vagueness is superior to any version of *de re* vagueness, and with the minority in thinking epistemicism superior to any version of the semantic variety. But there are those who hold firm.¹¹ What would boundaries be like for *de re* vague objects if (*per impossibile!*) there were some? One theorist who has written on this topic is Ned Markosian. Markosian's approach (2000*a*) seems to rely on four assumptions: (i) that vague objects are always objects with indeterminate parts; (ii) that indeterminate parthood requires the thesis that parthood comes in degrees (other than 0 and 1); (iii) that those who accept (ii) will want to accept non-classical fuzzy sets (sets in which membership likewise is a matter of degree); and finally (iv) that regions (taken to be sets of points) are among the sets whose membership can be a matter of degree. Of course, Markosian need not be read as insisting on any entailment relations from (i) to (iv), but might rather simply be describing what he thinks is the most plausible package of views for someone ready to acknowledge any kind of vague objects in the first place. I think the proponent of vague objects may reasonably resist at each of these points, however. There are scenarios not involving indeterminate parthood that would make for ontological vagueness including alleged indeterminate cases of existence, of identity, and perhaps even of location, and we might be interested in subtleties regarding boundaries in each of these divergent cases. I would prefer, then, to work with a broader notion of a *de re* vague object. Although some have certainly argued that parthood comes in degrees, and that fuzzy sets are well suited to solving a variety of puzzles involving composition,¹² one can accept condition (i) while denying (ii), accept (i) and (ii) while denying (iii), and accept (i)–(iii)

¹¹ See Tye 1990 and van Inwagen 1990*b*. I have said what seems right to me against ontological vagueness and in support of epistemicism in my 2001*a*: ch. 3.

¹² For example, in solving the so-called selection problem in the Problem of the Many; again, see van Inwagen 1990*b*. For worries that may undercut van Inwagen's approach see my 2001*a*: ch. 1.

while denying (iv). For those in agreement with Markosian in thinking that these four theses represent the best package deal, I refer you to his insightful discussion on the associated appropriate account of boundaries.¹³ For the remainder who would wish to resist one or more of (i)–(iv), I suggest the following hypotheses for scenarios involving cases of ontologically indeterminate parthood and location.

Suppose there is an object with indeterminate parts. To locate its indeterminate boundary, take all the entities which are determinate or indeterminate parts of the object, the x s, let r be the union of the regions exactly respectively occupied by the x s, and identify our object's indeterminate boundary with the set of all and only the boundary points of r . Its indeterminate material boundary (if it has one) is just the unique material thing that is the fusion of all the point-sized material objects located at the boundary points of r .¹⁴

Suppose that there is an object with an indeterminate location. To locate its indeterminate boundary, take all the points which either determinately or indeterminately fall within the object, let r be their set, and identify our object's indeterminate boundary with the set of all and only the boundary points of r . Once again, its indeterminate material boundary (if it has one) is just the unique material thing that is the fusion of all the point-sized material objects located at the boundary points of r .

I would like to draw attention to one potential shortcoming of these hypotheses, however. An oddity may arise if some object, O , and pair of items, x and y , are such that (i) indeterminately, O has x as a part; and (ii) indeterminately, O has y as a part; and (iii), determinately, O does not have both x and y as parts. In that setting, the proposal might seem to deliver a boundary that is determinately too large. Similar considerations arise should it be the case for some object, O , and pair of points, p_1 and p_2 , that (i) indeterminately, p_1 falls within O ; and (ii) indeterminately, p_2 falls within O ; and (iii) determinately, it is not the case that

¹³ Eventuating in this: "A Vague Objects Definition of 'Boundary': B is the *boundary* of object $x =_{df}$ B is the fuzzy set of all *determinate* and *indeterminate* boundary points of the region occupied by x , and each member of B is a member of B to the degree to which it is a *boundary point* of that region." See Markosian 2000a.

¹⁴ Of course, this presupposes no infinite descending chain of indeterminate parthood relations, but that would seem to require material atomless gunk, and gunk is unavailable.

both p_1 and p_2 fall within O . Notwithstanding this drawback, though, these proposals currently seem quite plausible to me.

Finally, should it turn out in the end that all such vagueness is non-ontological after all, then I am willing to follow the counsel of the epistemists; there are no vague boundaries and no need for super-valuationist remedies. Indeterminacy lies neither in the object nor in the meanings of our terms, but rather in our knowledge.

Concealed boundaries

Suppose we cut a closed, solid sphere into two hemispheres. Naturally, one expects one of the hemispheres to be closed and the other to be partially open, or (if it is a particularly sloppy cut) both the hemispheres may wind up partially open. The cut, one would imagine, brings a formerly concealed surface to light. There has been recent resistance to this picture, however. Hear the dissenting voices of Casati and Varzi:

Suppose we dissect a solid sphere made of some perfectly homogeneous prime matter. Which of the two resulting half-spheres will be closed? This is an embarrassing question. But it arises, we submit, only on the basis of an incorrect model of what happens topologically when a process of cutting takes place. Topologically, the cutting of an object is no bloodstained process—there is no question of which of the two severed halves keeps the boundary, leaving the other open and bleeding (as it were). Rather, topologically the explanation is simply that the outer surface of the sphere is progressively deformed until the sphere separates into two halves. To put it differently, the cutting does not “bring to light” new surfaces that were trapped inside the sphere. (Casati and Varzi 1999: 87)¹⁵

Casati and Varzi try to prevent us from taking issue with this by arguing that whereas there is “something deeply problematic about the magic moment of separation”, this may be said of any topological change—such as the transforming of a sphere into a torus. I believe the cases are not at all similar. Drill a hole through a sphere, and it becomes a torus; but the process will involve either annihilating or displacing some material. Cut the sphere, and there need be no annihilation or displacement; the two-dimensional disc whose perimeter is the sphere’s equator must go *somewhere* when the sphere divides in two. On

¹⁵ Such resistance can also be found in Smith and Varzi 2000.

the assumption that the cut wasn't sloppy, *it* didn't go under the knife.¹⁶ What are the options? It either goes left or right or out on its own or into oblivion. Now, if it goes out on its own, then (contrary to our hypothesis) we made two cuts, one on each side of the disc; and if it goes into oblivion, we have more than a topological mystery on our hands. But if it goes left or right, then a previously concealed material boundary—and a material boundary of uncountably many proper parts of the sphere at that—is brought to light. Alternatively, perhaps it goes left, and the cutting causes the parts on the right hemisphere to redistribute themselves so that upon completion of the process the right hemisphere has a closed surface, too. But that wouldn't show that a previously concealed material boundary had not been brought to light—there it is, after all, lying exposed on the left—it would just show that certain processes have peculiar causal powers.

I take it to be a virtue of the account of material boundaries presented above (together with the doctrine of arbitrary undetached parts which informs us that any subregion of a sphere is exactly occupied by a material object just as real as you or I) that in the end this question need not be classed with the embarrassing ones and that we need not appeal to the admittedly general mystery of topological magic. True enough, bend a tube open at one end and closed at the other into a donut and its topology changes from partially open to closed, and from sphere to torus. But slice the tube in half, and the material objects that were around before the cutting are around after (albeit some of them in scattered form). Perhaps the cutting metaphor is misleading. Without changing their relative positions, beam to the other side of the room all the point-sized grains collectively occupying the bottom half of a closed sphere. You might think that such incomplete instructions leave you with options, but if we take the *fi* at phrase 'bottom half' to include all the points in the lower closed hemispherical region, then 'post-cut' you will find a partially open hemisphere with only a partial material boundary in one corner and a closed hemisphere with a complete material boundary (now brought to light) in the other.

¹⁶ This is not meant to oppose Smith and Varzi's (2000) work on *fiat boundaries*, according to which the northern hemisphere and the southern hemisphere in some sense share this disc as the result of *fi* at articulations. Rather, it is to exploit the backdrop metaphysics of the present work, which takes the disc to be a fully material object to be reckoned with—even when embedded within the sphere.

§6 A Knot

Let us take as granted the liberal view of receptacles defended in Chapter 2 and the analyses of touching and boundaries defended in the previous sections of this chapter. Here is a knot to untie.¹⁷

Somewhat surprisingly (as we have just seen), zero-dimensional objects can be either closed or partially open. Similarly, one-, two-, and three-dimensional objects can be either closed or partially open. Just which objects can be open, however, depends on the number of spatial dimensions—for only n -dimensional objects can be open in an n -dimensional space.

Let's have some items before us. Let a *grain* be a single, point-sized object. Let a *zeno-stick* be a fusion of point-sized objects arranged in a zeno-series (as were our characters Bits and Pieces). Both are zero-dimensional, but grains are closed, while zeno-sticks are partially open. Let a *pole* be a line-segment-shaped object with a final point-sized part on both ends. Let a *spear* be a line-segment-shaped object with a final point-sized part on one end but no final point-sized part on the other. Both are one-dimensional, but poles are closed, while spears are partially open. Let a *disc* be a circular object with an unbroken ring of point-sized parts on its perimeter. Let a *smear* be a circular object with no point-sized parts on its perimeter. Both are two-dimensional, but discs are closed, while smears are partially open. Let a *globe* be a spherical object with an unbroken sphereshell of point-sized parts on its surface. Let a *mace* be a spherical object with no point-sized parts on the sphereshell-shaped space that serves as its boundary. Both are three-dimensional, but globes are closed, while maces are either partially open (if there are more than three spatial dimensions) or else open (if the number of spatial dimensions is three).

Let us say that two objects are on a *collision course* when they are oriented in some fixed way with respect to one another and are moving towards one another so that if they were to continue to travel undisturbed, they would either (i) pass through one another, (ii) come into

¹⁷ Treatments of the puzzle (varying in their degrees of comprehensiveness in presentation and discussion) can be found in Kline and Matheson 1987, Zimmerman 1996a, and Lange 2002.

contact with one another, or (iii) slow down, jump, stop, turn, or otherwise deviate from their paths. Finally, let us say that when two objects on a collision course suffer fate (i), they *interpenetrate*; when they suffer fate (ii), they *touch*; and when they suffer fate (iii), they are *unsocial*.

Recall once again the Introduction and the ban on the co-location of material objects and the endorsement of the doctrine of arbitrary undetached parts. Accordingly, I am committed to the claim that interpenetration is never an option for two objects on a collision course; for interpenetration is not mereological overlap, and given the doctrine of arbitrary undetached parts, interpenetration would require the co-location of material parts.

Now (restricting the following thought-experiment to three-space) for each respective pairing from our list of object types (i.e., grain, zeno-stick, pole, spear, disc, smear, globe, and mace) consider the question, “Is there any orientation two such objects might take such that their traveling undisturbed in that orientation on a collision course will lead them to touch one another?”

As should be apparent, (i) our partially open objects (zeno-sticks, spears, and smears) are adventurous—they will touch anything; (ii) our open objects (maces) are selective—they will touch anything except other open objects; and (iii) our closed objects (grains, poles, and discs) are selective—they will touch anything except other closed objects. Note, however, that closed objects are even more selective than their open cousins, for the closed objects always manage to stay some non-zero distance away from their own kind, whereas open objects are content to share (partial) boundaries with their own kind.

I find the results above both predictable and interesting, but not nearly as interesting as are the results from this second inquiry, which (for each respective pairing) aims to answer the question, “Is there any orientation two such objects might take such that their traveling undisturbed in that orientation on a collision course will lead them to be unsocial?”

What strikes me as especially intriguing about this second inquiry is that it will turn out that any pair can offend each other and engage in unsocial behavior, except for an open object, which always forgives a closed object, no matter what its orientation. That is to say, with the exception of pairing a closed object (e.g., a grain, pole, disc, or globe)

with an open object (e.g., a mace), any other pairing can be so oriented that both interpenetration and touching are not options; the items paired *must be unsocial*—they must either slow down, jump, stop, turn, or otherwise deviate from their courses. And note that it would not help to restrict ourselves to the view that all material objects are at least three-dimensional and open; for, as noted earlier, this sins against the no extended simples rule (and it likewise violates the doctrine of arbitrary undetached parts).

What's so puzzling about all of this, then? The difficulty is not merely to explain why we can always find an orientation for almost any pair of objects which guarantees that their collision course will lead to unsocial behavior. Given the discussion above, we can clearly explain *that* such deviant behavior will occur, but just what explains *why*?

Let me summarize a bit. Assume a continuous three-space or more-than-three-space (I don't mind which) that contains some material objects finite or infinite in number (I don't mind which). Grant (i) the liberal view of receptacles from Chapter 2, (ii) the analyses of touching and boundaries from Chapter 3, and (iii) the ban on co-location and the endorsement of the doctrine of arbitrary undetached parts from the Introduction. If you don't grant the relevant assumptions, you can untie the knot,¹⁸ while if you do grant the relevant assumptions, you will have pairs of objects which, when oriented in the right way and sent on a collision course, must be unsocial. So, once again, just what explains the unsocial behavior? *Why* must approaching objects change speed or direction? I don't know—that's why the title of this section advertises a knot rather than a knot untied.

A short way with the puzzle: There is no problem here. You've simply stacked the deck so that the objects in your stories must satisfy

¹⁸ One author who doesn't (and who has written on this topic) is Dean Zimmerman. In his 1996a, he worries about the assumption of a continuous manifold and takes the general problem of this section to be the core of an argument for the possibility of atomless gunk. Here I cannot follow Zimmerman, for, as noted in the Introduction, I have offered sustained arguments against the possibility of atomless gunk, and in the present work I take those arguments as read and write under the precarious assumption that they are successful—see my 2001a: ch. 3. But I would like to pause to say this: Zimmerman's 1996a is an excellent paper revitalizing an undeservedly neglected problem, and unlike the uneasy tension which will characterize the rest of this section, he at least settles on and defends one reasonable and attractive line of response.

certain descriptions and then act all mystified about just what cosmic miracle explains their allegedly strange behavior. But there's really nothing left to explain. The objects will act in those ways because of the constraints you've laid down on the case.

A short way with the puzzle blocked: The constraints in question are not supposed to be stipulations laid down in a thought experiment; they are supposed to be metaphysically necessary truths about material objects. Discovering such truths (if truths they be) explains only *that* pairs of objects on a collision course will be unsocial, but which kinds of unsocial behavior they will exhibit, together with what (if anything) determines the behavior, are still respectable topics of inquiry.

One answer (that I don't much care for) is that certain topological features are essentially joined to certain repulsive forces.¹⁹ In the language of the Introduction, it is in virtue of their topological features that material objects *dominate* certain regions. (Recall that when an object dominates a region, other material things are excluded from it, either because regions are monogamous and the object's parts are already to be found there, or because its parts manifest repulsive forces which prevent any (although perhaps we should here say 'some') material things from intruding.) This could seem like a bearable bullet to bite for some, but it may appear to be a little less attractive for one who (like me) believes in the liberal view of receptacles or else (again like me) believes in fairly liberal principles of recombination fueled by accepting the possibility of point-sized objects and universalism and in the doctrine of arbitrary undetached parts. The reason why either of these background beliefs would generate trouble is that they straightforwardly lead to countenancing, for example, the possibility of a perfectly solid closed cube, whose myriad internal parts of different topological shapes would allegedly all be busy repelling one another (but not in such a way as to break up the cube). Just to be clear, this isn't an inconsistency—but, by my lights, it's a rather unattractive solution.

Another short way with the puzzle: The puzzle dissolves once we note that we have simply decided to use the term 'material object' in a

¹⁹ Zimmerman's 1996a gets a lot of mileage out of pushing for the implausibility of this suggestion.

certain restricted way. We can insist that the very concept of a material object forbids interpenetration and co-location if we like, but then we should be no more surprised that material objects never interpenetrate than we are that widows were once married—its truth goes analytic. Ted Sider (2000) has offered a witty parody of the candidate solution reported in the previous paragraph by defining ‘permanent bachelor’ as a male who never marries and then by pointing out that we need not posit any mysterious anti-nuptial force to explain his behavior. Why does no permanent bachelor ever reach the altar? Different stories for different cases—there is no cross-world uniform explanation. But, of course, there are also worlds where men do marry, and who thereby in those worlds fail to qualify for the description ‘permanent bachelor’. Similarly, there are worlds where two closed space-fillers pass right through one another without sharing parts—and if we insist on hijacking the word ‘material object’ in a certain way, then they are thereby disqualified for that description, too. But once we recognize the analyticity in play, the puzzle is not really worth getting worked up about.

Another short way with the puzzle blocked: This attempt at dissolving the trouble depends (i) on construing the ban on co-location as analytic, and (ii) on the metaphysical thesis that space-fillers can interpenetrate and share locations without sharing parts. Whether or not Sider’s target, Zimmerman, intended to maintain (i), the puzzle can be revived by explicitly rejecting (ii)—a rejection I have endorsed since the Introduction.²⁰ As I see it, then, there is no need to

²⁰ Two points: First, to be fair to Sider, when characterizing this portion of the argument from Zimmerman 1996a, he cites Zimmerman’s sect. 2, whose title is “the *concept* of an extended material object” (italics, mine). Second, I imagine that I might have some frustrated readers who at this point are thinking, “But I don’t agree about that ban on co-location, and the author’s tiresomely repeating that refrain really isn’t going to do much to change my mind about it.” Fair enough—no reason to get uppity about it!—such readers are invited to solve the puzzle by rejecting one of my starting points. But I would like to avoid any criticism of false advertising. On the first page of this book, I announced that the final results I aim for in this work are largely conditional—i.e., if we accept foundations of such and such a kind, then we ought also to endorse such and such a philosophical view, and the metaphysical impossibility of co-location was among the handful of principles in that foundation. I have attempted to argue against those reasons for co-location that are rooted in constitution theory (my 2001a), and as noted earlier in this chapter, I have also argued against co-location on the grounds that it forfeits either

construe 'being essentially unable to share its location' as a constituent concept of 'being a material object'. Rather, the claim that "a material object is essentially unable to share its location" (where 'material object' denotes a space-filling substance rather than, say, a region, hole, or event) is a non-logical, metaphysically necessary truth on a par with "a material object has at least one part".

Back to candidate solutions, then. Another answer (that I like even less) is that it is not the topological features that are essentially joined to certain repulsive forces, but rather the fundamental types of material objects that are so shaped. Accordingly, which regions an object dominates are determined by the nature of the object, a feature which turns out also to determine its topology. For example, perhaps owing to their natures F-objects always come in closed varieties and G-objects always come in open varieties, and like repels like. Again, though, this is a nonstarter for anyone who accepts our earlier restrictions, for any open object must be extended, and where we have extended open G-objects and the doctrine of arbitrary undetached parts, we have closed G-objects, as well.

Here is another pair of answers (that I don't like at all, but that I record in something like an attempt at comprehensiveness). First, whenever two items on a collision course that would require unsocial behavior are sent on their way, at some very close distance they will be prevented from further advance by the sudden appearance of a mediator with which both can touch (e.g., a javelin appearing between two closed cubes). Second, whenever two items on a collision course that would require unsocial behavior are sent on their way, at least one will be prevented from further advance by its abrupt annihilation. But these miraculous creation and annihilation "solutions" seem moves of desperation to me.

Another answer (that at least has the virtue of being available to me) is that when two items on a collision course that would require unsocial behavior are sent on their way, at some distance one will cause the other to redistribute some of the point-sized pieces near its surface (changing,

the pointy view of simples or universalism, both of which I take to be more defensible at the end of the day. But once again, no hard feelings if you don't share the intuitions and arguments which lead to regarding this puzzle as genuinely problematic. Feel free to turn it on its head and treat it as an argument for co-location, if you like. That's interesting, too.

for example, a disc into a smear without loss or addition of parts) so that the two objects touch, after all. Unfortunately, this solution seems to leave a lot up to bruteness—e.g., why is it the closed cube on the left whose rightmost surface happened to change rather than the leftmost surface of the closed cube on the right, given that they were the same size, made of the same material, traveling at the same speed, and so on? Moreover, it functions as only a partial solution at best, since even if for some unexplained reason a salient surface switch turned most cases of would-be unsocial behavior into cases of contact, it could not double as an explanation of the unsocial behavior of grains or zeno-sticks, which simply do not have enough point-sized parts to redistribute.

What's left? One inevitably and respectfully steps aside? They face off in an eternal standstill like the North-going and South-going Zax? At the last moment before the metaphysical absurdity of co-location threatens, they discontinuously jump past one another? Calling a truce but being unwilling to stop, each cooperatively slows its approach *Zeno-style*?²¹

Of course, perhaps there is no uniform explanation, but instead at some worlds there are jumps, at others annihilations, at others mediators, at others repulsive forces, and so on. But one can still find the relevant disjunction unsatisfying, as I do, although at present I don't see anything better. On a personal note, one redeeming feature of this otherwise frustrating perplexity is that once again I have managed to subscribe to a collection of views that all seem right to me but that jointly seem to require one of a number of outcomes that all seem wrong to me, and I suspect that there is some genuine fun to be had either in happening upon some new and acceptable outcome or else in successfully ferreting out the initially attractive view responsible for the perplexity; I just hope it doesn't turn out to be one of my favorites.

§7 Four Colors Do Not Suffice

It is now time to close the chapter with what I hope will be an entertaining interlude. While reflecting on the topics of contact and

²¹ Perhaps this last option is defended by Varzi 1997, when he says, "From the fact that two closed entities cannot be in contact it does not follow that they cannot come into contact". But if so, this is just another bit of unsocial behavior, since the objects continually drag their feet to perpetually prolong their meeting.

boundaries, I found myself thinking of the infamous four-color theorem in mathematics. In an attempt to share some of my thoughts with my children, I wrote them a little story about the mythical land of Zenopia, where the four-color theorem surprisingly (but clearly) appears to fail. The more I thought about it, however, the more convinced I became that the four-color theorem (in at least two of its three allegedly equivalent formulations) really does fail, and that it should be replaced by what I like to call ‘the cartographic many-color thesis’. In this section, then, I leave you with the history of Zenopia.

Welcome to the flatland of Zenopia!

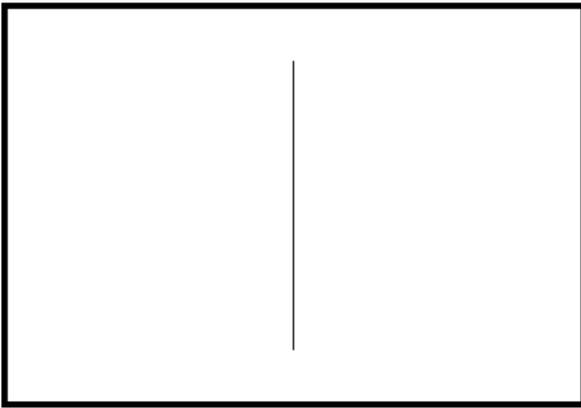


Figure 1. Zenopia.

Zenopia is a two-dimensional, island country with six provinces, each of which is fiercely proud of its infinite perimeter, and charmingly modest concerning its finite area. Topologically, Zenopia is a partially open rectangle (partially open, owing to a line segment region missing from the very center of its interior and running north to south). None of the inhabitants of Zenopia has ever made a fuss about the respectability of partially open regions, however, and neither, of course, should we. Let us call the sliver of space that is missing from the interior of Zenopia by the suggestive name ‘Border’, and let us mark it with a solid line (see Figure 1). (Remember, though, that whereas the line has width, Border does not. Such are the hazards of convenient representations.)

The second province in Zenopia is Blackland, and it, too, is a curious province. Blackland is exactly like Redland, just turned upside down and running east to west rather than west to east. Just a bit north and a tad west of the southeast corner of Zenopia, Blackland begins its own long and winding path through the eastern half of the country. Blackland is just as predictable as its sister province, Redland: it shoots straight north, turns west, drives south, turns west, shoots north, turns west, and endlessly meanders as proficiently as does its western sibling. Moreover, like Redland to the West, those segments $1/n$ th of a kata from Border are $1/n$ th of an ana in width, and thus its founders ensured that (despite the fact that no one could walk the province end to end) it never encroaches upon the western half of Zenopia. Blackland and Redland alike, however, do manage to get arbitrarily close to every point that falls within the region we have named Border.

The old maps, which describe the country before the settling and boundary-fixing of the later provinces, represented the island of Zenopia as shown in Figure 3.

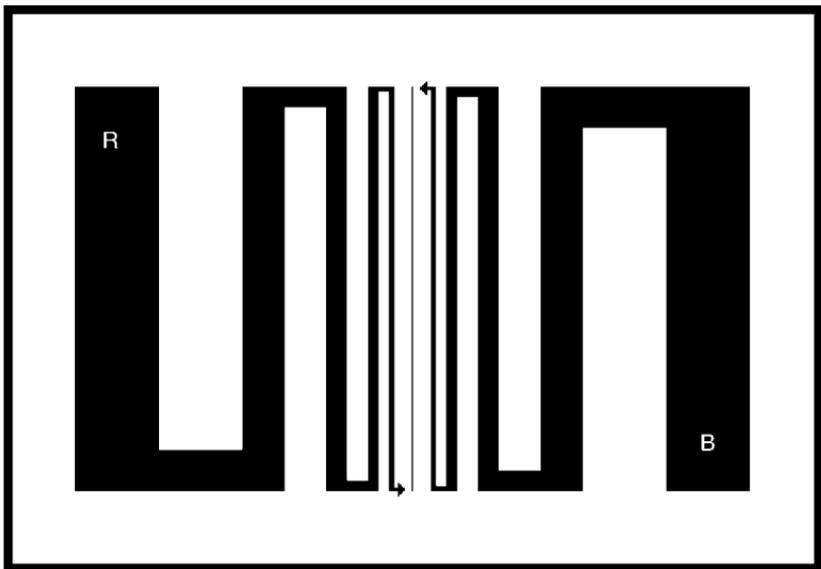


Figure 3. Blackland.

Then the trouble came. Four native peoples among the flatlanders of Zenopia began to quarrel about who had genuine authority over what was once best called the third original province in Zenopia (i.e., the province that is just the complement of the union of Redland and Blackland in Zenopia and that is represented by the color white in Figure 3).

The Northwesterners, the Southwesterners, the Northeasterners, and the Southeasterners all claimed that governance should be theirs, and a long and bitter war ensued. The result was that the third original province in Zenopia was divided equally among the four native peoples, the Northwesterners occupying Light Greenland (Figure 4), the Southwesterners occupying Dark Greenland (Figure 5), the Northeasterners occupying Dark Blueland (Figure 6), and the Southeasterners occupying Light Blueland (Figure 7).

As history would have it, the Northwesterners and the Northeasterners settled their differences rather peacefully and were happy to share a segment just north of Border, each staying within its respective half of the country (halving west/east). Similarly, the Southwesterners and the Southeasterners resolved their differences in an admirable way and met

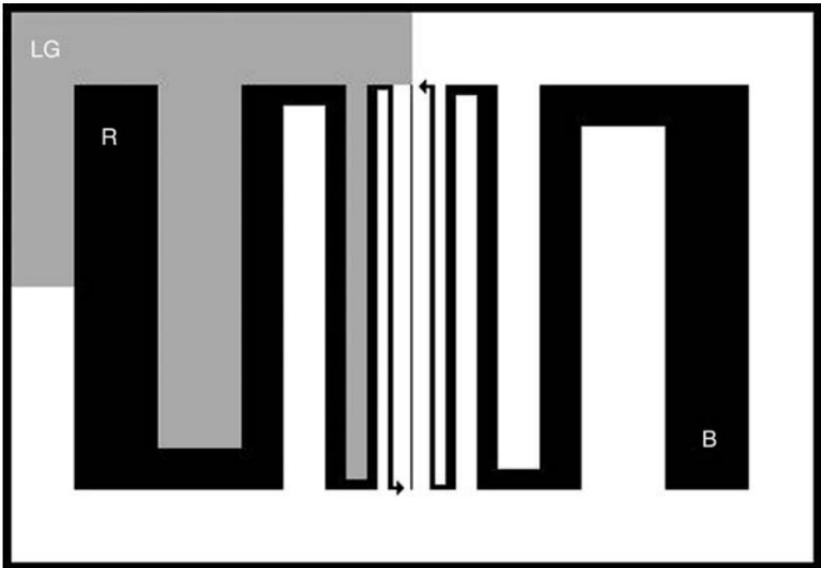


Figure 4. Light Greenland.

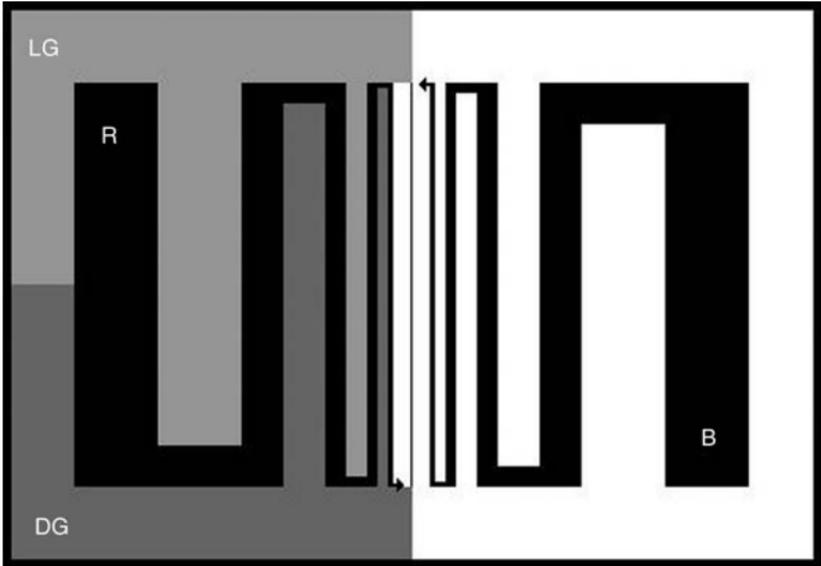


Figure 5. Dark Greenland.

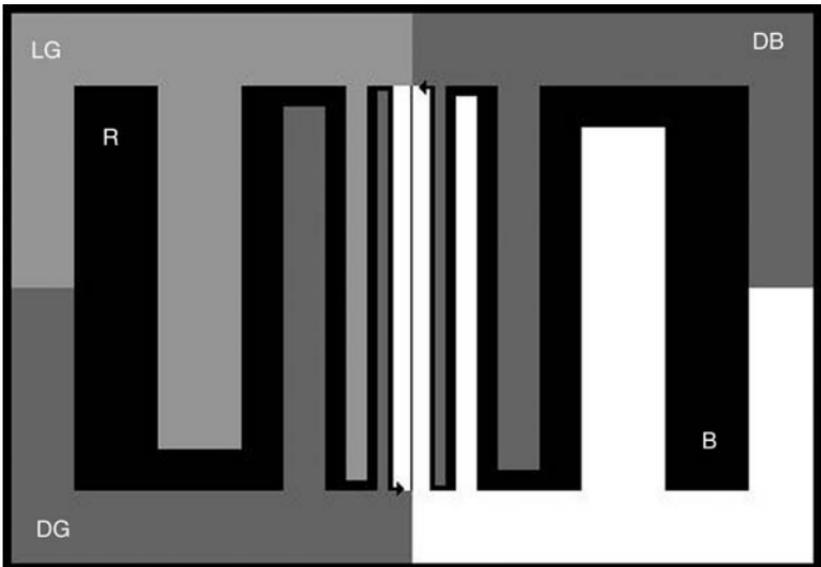


Figure 6. Dark Blueland.

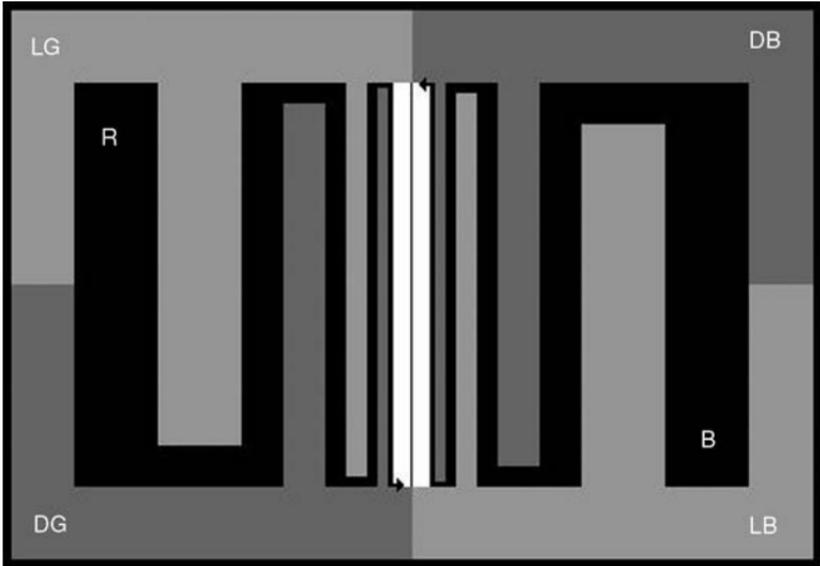


Figure 7. Light Blueland.

at a segment just south of Border, each agreeing to remain in its respective half of the country (again halving west/east). And no one, it seemed, had any claim to press against either Redland or Blackland, which, remaining neutral, neither lost nor gained one smidgen of land during the war.

Unfortunately, the Northwesterners were not as amicable toward their neighbors the Southwesterners, whom they thought had always tried to occupy much more of the west than was really their due. The Southwesterners, it turned out, had a similar take on their neighbors to the north, and although they battled to a stand-off and an uneasy truce along the border that separated them midway along the western coast, the Northwesterners took great delight in occupying as much of the southwest as they could under the protective width of Redland's zigzagging march through western Zenopia. That is, whenever Redland took a turn towards the south only to rise again to the north, the Northwesterners claimed all the territory in the resulting gap. Not to be outdone, the Southwesterners claimed the gaps generated by every Redlandish northward turn followed by a fall to the south. In what can only be called a coincidence of truly astonishing proportions, the

fate of the Northeasterners and the Southeasterners was so similar as not even to require another paragraph in the telling.

As you no doubt have noticed, I have followed the usual convention of mapmaking for Zenopia in leaving the central region close to Border uncolored, with the characteristic arrows of Redland and Blackland showing those with finer-tipped paintbrushes the way onward. Such is the convention, but not because any point in the country is unclaimed—far from it: every last point has its home in a province, and no point is in dispute. Rather, it's just that Redland, Blackland, and the coveted gaps get so very thin so very quickly. But slopping down real colors matters not to the patriots of Zenopia. Coloring in principle . . . that's the thing!

Thus did the island country of Zenopia acquire its six provinces, each a connected region. Periodically some dispute or other arises over shared borders, primarily surrounding the question of whether two regions can both claim a common line segment that divides them (causing the regions to intersect in what everyone regards as a really intolerable way), or whether one of the two regions could claim the extra victory of sole possession of the line segment, while its opponent suffered the humiliating fate of being bounded by points in Zenopia that properly fell within an enemy province.

But whatever becomes of those border disputes, nothing compares to one absolutely stunning result of the war. The unquenchable desire of the Northwesterners, the Southwesterners, the Northeasterners, and the Southeasterners to fill the gaps so dutifully carved out by Redland and Blackland guaranteed that the provinces of Light Greenland, Dark Greenland, Dark Blueland, and Light Blueland also managed to get themselves arbitrarily close to every point that falls within Border.

To be just a bit more careful: let an open disc about a point p be the set of all and only those points less than some fixed distance from p . In that case, every point p on the line segment Border is such that, for every open disc d about p , d has a non-empty intersection with each of the six provinces and with the complements of each of the six provinces. But that's just what it is for a line segment to be a common boundary; that's all it takes for such provinces to be adjacent.

Zenopia, then, cannot be four-colored. Four colors do not suffice to color Zenopia so that no two adjacent provinces are the same color—six are required. Moreover, word has it that the troubles in Zenopia aren't over. There have been rumors that a small faction of Southwesterners

are intending to carve up Dark Greenland by declaring independence with a smallish province of their own, the geographical plan for which calls simply for a careful surveying of Redland and a subsequent shadowing of that fair region in all of its twists and turns by another region that is a thousandth of the width of Redland (appropriately narrowing, as does Redland, at every eastward turn) and that at none of its width-wise cross-sections is further away from Redland than it is itself wide at that very cross-section. Although this would-be seventh province need not share all of Border with its predecessors, it would be sure to share a certain subregion of Border (a subregion that is itself a line segment) with each of the others. Seven colors, then, would be in demand. Given the other symmetries to be found in Zenopia, it would not be at all unreasonable to expect that the number might rise ever higher.

The moral of the story: do we, then, have a counterexample to the celebrated four-color conjecture? Well, that *depends* on exactly how the conjecture is formulated, and unfortunately, formulations that are widely taken to be equivalent may in fact not be equivalent. Here is a representative formulation from Saaty and Kainen (henceforth termed the “four-color conjecture map version”) drawn from the opening of their very popular book-length introduction to the four-color problem (1977: 4).

(4CCM): Four colors are sufficient to color any map drawn in the plane or on a sphere so that no two regions with a common boundary line are colored with the same color.

Shortly after introducing the conjecture, Saaty and Kainen remind us that we may obtain a dual graph $D(M)$ when we “place a point, or *vertex*, in the middle of each country of some map M and join two vertices with a line, or *edge*, whenever the two countries have a common border” (1977: 5). Accordingly, it is commonplace to hold with Saaty and Kainen that the four-color conjecture stated in its regional form (4CCM) “is equivalent to the statement that we can four-color the vertices of certain kinds of graphs; namely, those which are dual to maps” (1977: 5). In other words, (4CCM) is equivalent to what we may term the “four-color conjecture dual graph version”:

(4CCG): Four colors are sufficient to color any dual graph (of a map drawn in the plane or on a sphere) so that no two vertices connected by an edge are colored with the same color.

The strategy then becomes clear. One can attempt to prove (4CCM) by defending the claims that (4CCG) is true and that (4CCG) is equivalent to (4CCM). But (4CCG), in turn, is frequently taken to be equivalent to what we refer to as “the four-color conjecture planar graph version”:

(4CCP): Four colors are sufficient to color any planar graph so that no two vertices connected by an edge are colored with the same color.

Representative reasons to believe that (4CCP) is equivalent to (4CCG) are given by Saaty and Kainen when they write, “it is interesting to note that in trying to four-color a map, we shall find that there is no local obstruction; one cannot have five mutually adjacent regions,” and “any connected graph which can be drawn in the plane is dual to some map . . . [moreover] . . . by its very construction, any dual graph $D(M)$ has the property of being planar; i.e., we can represent its vertices and edges in the plane so that edges cross one another only at common endpoints” (1977: 5).

However, as we have just seen, the quick route to multiplying provinces in Zenopia reveals a number of truly surprising things. In short, whereas (4CCP) is true (and famously proven to be so (Appel and Haken 1977)), (4CCG) and (4CCM) appear to be false. That is, even if every planar graph is four-colorable, the dual graph of Zenopia is not planar; rather, the dual graph of Zenopia is the complete, nonplanar graph commonly denoted by K_6 (see Figure 8), and neither Zenopia nor its dual graph K_6 is four-colorable.

To see why the dual graph of Zenopia is properly taken to be K_6 , recall once again that there are exactly six provinces in Zenopia. Thus its dual graph will have six vertices. Now whenever two provinces in Zenopia are adjacent along a border, its dual graph will require an edge that links the two vertices representing those two provinces. But choose any of the possible pairings from our grouping of six provinces: whichever pair you choose will be adjacent along the line segment named Border in the history that we have related. Accordingly, for each pairing of provinces, our graph will require an edge linking the vertices that represent them. But then the resulting graph is just the complete, nonplanar graph known as K_6 .

In fact, reflection on Zenopia teaches us a lesson that we may call “the cartographic many-color thesis”: for any natural number n greater

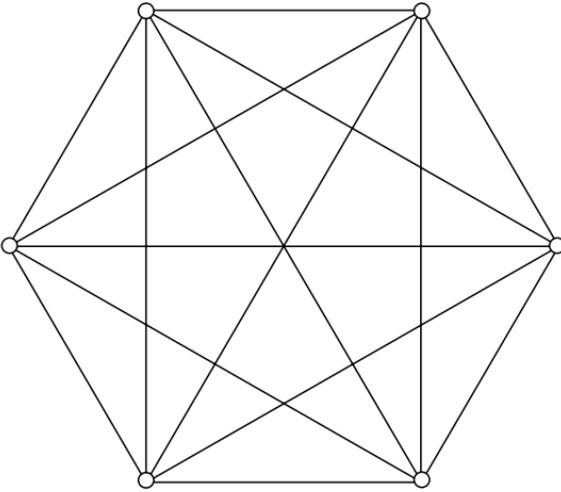


Figure 8. The graph K_6 .

than 4, it is possible to construct a complete, nonplanar graph m such that (i) m has n vertices; (ii) $n-1$ colors do not suffice to color m , so that no two edge-connected vertices are of the same color; and (iii) m is a dual graph of an admittedly peculiar, but perfectly respectable geographic map.

4

Extended Simple and Diachoric Identity

§1 Character Sketches

The characters of this chapter include regions of a substantialist spacetime and material objects. A *substantialist spacetime* is a concrete particular with an ontological status not reducible to relations between those material objects and events which bear to it a variety of occupation and orientation relations. Once again, whereas subregions of this spacetime could be taken to be mere pluralities of points, and whereas we have occasionally discussed subregions indirectly by invoking the sets that have the relevant points as members, I see no significant impediment to identifying the subregions with mereological fusions of concrete, unextended, simple points. Just to be clear: for the purposes of this chapter I am setting to one side the relationist challenge to the substantialist conception of spacetime. And I am endorsing (without argument) the continuous over the gunky and discrete conceptions of spacetime.¹

A *material object* is an object each of whose parts occupies a region of spacetime (where occupation is not identity). A *material simple* is a material object with no proper parts. A *material composite* is a material object with proper parts. A *clean composite* is a material object which both has proper parts and also can be decomposed without remainder into simples. A *hunk of material gunk* is a material object each of whose proper parts has proper parts. A *hybrid composite* is a material object with proper parts some of which are simple and some of which are gunk. Just to be clear: for the purposes of this chapter I am setting to one side the debate over the possible existence of gunk and hybrids and will focus

¹ On substantialism see Earman 1989, Nerlich 1994, Sider 2001, and Van Cleve 1987. On the competing continuous, gunky, and discrete conceptions of spacetime, see Forrest 2004, 1996, and 1995.

instead entirely on simples and clean composites (hereafter, just ‘composites’). I am endorsing (without argument) the occupation conception over the reductive or location or extension conceptions of material objects. And I am ignoring complications of vagueness, working instead under the problematic assumption that occupation is never a non-epistemically vague relation.²

Finally, I adopt as my central theme an investigation of the different ways in which our characters interact (i.e., the different ways in which material simples and composites can occupy or be located at regions of spacetime).³

§2 Occupation Relations

Although these entities belong to different ontological subcategories of concrete things, material objects (whether simple or composite) and regions of spacetime (whether simple or composite) stand in a variety of location relations. One goal of this paper is to explore different candidate descriptions of these kinds of occupation and to investigate some of the philosophical difficulties which arise for the resulting conceptions.

Although excellent work has been put forth in the neighborhood of this issue, I think that some philosophically interesting distinctions and puzzles have been overlooked or run together. There are many ways into our topic. Let us begin by posing a pair of questions about locations.

(Q1): When a material object, x , is located at a non-point-sized region, r , is x thereby located at each of the subregions of r , as well?

(Q2): When a material object, x , is located at each of two regions, r and r^* , is x thereby located at the fusion of r and r^* , as well?

I believe that affirmative answers to (Q1) can come from two very different kinds of theorist. I take ‘is located at’ as primitive. I am using ‘is

² On simples and gunk see Hudson 2001*a*, Markosian 1998, Zimmerman 1996*a* and *b*, and the essays by Forrest, Hazen, Hawley, Hawthorne and Weatherston, Markosian, Nolan, Simons, and Uzquiano in Hudson 2004*b*. On the competing occupation, reductive, location, and extension conceptions of material objects, see the Introduction, Markosian 2000*b*, and Sider 2001. On a theory of vagueness that would support the problematic assumption confessed in the text, see Williamson 1994.

³ For the remainder of this chapter I shall use ‘occupies’ and ‘is located at’ interchangeably. Accordingly, no region is located at itself.

located at', however, in such a way that the object completely fills any region at which it is located (as opposed to 'located within', which suggests that the region might be vastly bigger than the object contained somewhere or other in the depths of its interior).⁴ Now consider the following five definitions derived from some recent work by Josh Parsons (unpublished).⁵

' x is entirely located at r ' =_{df} x is located at r , and there is no region of spacetime disjoint from r at which x is located.

' x is wholly located at r ' =_{df} x is located at r , and there is no proper part of x not located at r .

' x is partly located at r ' =_{df} x has a proper part entirely located at r .

' x pertends' =_{df} x is a material object that is entirely located at a non-point-sized region, r , and for each proper subregion of r , r^* , x has a proper part entirely located at r^* .⁶

' x extends' =_{df} x is a material object that is wholly and entirely located at a non-point-sized region, r , and for each proper subregion of r , r^* , x is wholly located at r^* .⁷

⁴ For the remainder of this chapter I intend to avoid the locution 'exactly occupies'. It may seem that there is a very natural way to introduce this notion given the definitions that appear below, but as we will see in the discussion to follow, we will have some unexpected options to choose from when assigning a meaning to that phrase. I acknowledge that I use 'exactly occupies' elsewhere in the text, but I am not trying to feign neutrality on the different ways in which objects can be related to regions in the other chapters.

⁵ The first two definitions (i.e., of 'entirely located' and 'wholly located') and the fourth and fifth definitions (i.e., of 'pertending' and 'extending'), while inspired by Parsons, use a different primitive and have a different content from the definitions given to those phrases by Parsons. Note that the definition of 'entirely located' involves a claim about the non-existence of a certain kind of region, while that of 'wholly located' involves a claim about the non-existence of a certain kind of object. Parsons correctly emphasizes the importance of this distinction.

⁶ In this and the definitions to follow, I use 'non-point-sized' rather than 'extended' in order to be neutral (i.e., in order to leave open the possibility of a receptacle that is the fusion of at least two yet no more than countably many point-sized regions—a region which would then be both non-point-sized and non-extended).

⁷ Why the fanciness? Why not just say ' x extends' means ' x is located at a non-point-sized region and is a mereological simple'? This won't do, for the proposed definiens would then apply to three of the four different ways in which a material object may be thought to be related to regions (to be discussed below), and one of the main aims of this chapter is to clearly distinguish those different ways.

The first kind of theorist who would offer a qualified affirmative answer to (Q1) is one who thinks that all non-point-sized material objects are composite and pertend. Given the definitions of ‘partly located’ and ‘pertending’, then, the pertension theorist holds that the attenuated sense in which the answer to (Q1) is affirmative is that when a material object, x , is located at a non-point-sized region, r , x is partly located at each of the subregions of r as well (even if x is neither wholly nor entirely located at those regions). This theorist need not, however, add that ‘being partly located at region r ’ entails ‘being located at region r ’ (i.e., unlike being entirely located or being wholly located, being partly located need not be regarded as a species of location *simpliciter*).

The second kind of theorist who would answer (Q1) in the affirmative is one who thinks that some non-point-sized material objects are composite and pertend, while others are simple and entend. What one may have thought was exclusively an a priori battlefield has recently been an arena in which a posteriori arguments from contemporary physics have provided unexpected support favoring recognition of some entending objects.⁸ Although these two kinds of theorist agree in some way or other to an affirmative answer to (Q1), they disagree about whether an object’s occupying a non-point-sized region guarantees that it sports proper parts. I do not mind characterizing this disagreement with the slogan “Only the entending objects are always located at each of the subregions of the regions at which they are located,” but I resist the characterization which instead employs the slogan “Only the entending objects are simple and multiply located”, for, as will become clear in the sequel, I think there is a neglected alternative in this discussion equally suited to claim the latter description.

As for the remaining view, I don’t know of anyone who maintains that all non-point-sized material objects entend. It might seem that the nihilist about composition who is also a three-dimensionalist about persistence would be a candidate for this view, but this theorist will end up somewhere else in the classification to follow. Expecting no complaints from adherents, then, I will suppress this remaining view in the discussion.

⁸ See the discussion of non-locality and quantum mechanics in Parsons, unpublished.

On the other hand, a kind of theorist who would answer (Q1) clearly in the negative is one who thinks that some non-point-sized material objects are spanners.

‘ x spans’ \equiv_{df} x is a material object that is wholly and entirely located at exactly one non-point-sized region, r , and there is no proper subregion of r , r^* , such that any part of x is located at r^* .⁹

For one (perhaps surprising) reason to take the possibility of spanners seriously, see David Lewis (1991) on singletons. Note, however, that on the occupation conception of material objects, any singleton that occupies a region occupied by its element will itself qualify as a material object—yielding a potentially unattractive commitment to material co-location.

Although the proponents of spanning objects accept (as do the friends of entension) the possibility of non-point-sized mereological simples, they deny (against both the pertension and entension theorists) that an object’s occupying a non-point-sized region guarantees that it either occupies or partly occupies each of that region’s proper subregions. Spanners do not enjoy any variety of multiple location.

Recall our second question:

(Q2) When a material object, x , is located at each of two regions, r and r^* , is x thereby located at the fusion of r and r^* , as well?

I believe that affirmative answers to (Q2) might initially seem automatic and inescapable. One who thinks that all material objects pertain is likely to imagine cases in which (Q2)’s corresponding conditional is vacuously satisfied on the grounds that pertaining objects are never located at more than one region (at best being partly located at more than one region). Or else (when reading ‘partly located’ for ‘located’) they will think that its antecedent is made true by a pair of proper parts of a pertaining object, and that its consequent is made true by their fusion (whether this be the whole of the given object or merely another proper part of the whole). One who thinks that some material objects entend may also consider cases in which the non-point-sized simple itself makes both the antecedent and the consequent of (Q2)’s corresponding

⁹ See McDaniel, 2004*a*, from which I borrow the term ‘spanners’. My characterization, however, differs from his in using ‘entirely located at exactly one’ and in replacing ‘continuous region’ with ‘non-point-sized region’ so as not to prejudge the possibility of spatially or temporally disconnected simples.

conditional true. Finally, one who thinks that some material objects span will not thereby see any threat to an affirmative answer, for a spanner also satisfies (Q2)'s corresponding conditional vacuously.

Nevertheless, I think that the same sorts of consideration that lead some to take entension seriously may also lead to uncovering a neglected notion of occupation and to a negative answer to (Q2). If we begin by thinking of 'being located at' as a one-one relation, we are left with a choice between pertension and spanning for non-point-sized material objects (and with some minor explaining to do involving partial occupying if we opt for pertension). Indeed, thinking that location is one-one and accepting the possibility of non-point-sized simples would be one straightforward motivation for accepting the possibility of spanners. But 'being located at' is a perfectly natural external relation, and without some argument to the contrary, perhaps one should take as a default position that a single material object can bear this relation to more than one region. Accordingly, the possibility of entension appears to gain some plausibility.¹⁰ But once one is willing to grant that 'being located at' can hold in a one-many pattern, one should not restrict that pattern without good reason, and entension embodies a restriction.

According to our account of entension above, when a material object entends, it is wholly located at each of the regions where it is located at all. But if we are willing to claim that occupation is a one-many relation, we might do well to resist the inference from the premise ' r is a subregion of the fusion of the regions occupied by material object x ' to the conclusion ' x is located at r '—the former relation need not bind the latter. Rather, we might briefly consider a (marvelously outlandish) maximally liberal proposal according to which any set of regions is such that there could be a single material object that occupies all and only the members of that set. Accordingly, there might be an object, O , and a spherical region, S , such that O bears the occupation relation to S and to a hemispherical-shaped subregion of S , H , but not to H 's complement hemispherical-shaped region in S , H^* .¹¹ I will be content to draw

¹⁰ See Sider, unpublished, who argues in this fashion not only for the possibility of a single material object occupying more than one region, but also for the possibility of a single region hosting more than one material object. Again, though, perhaps this establishes at best a presumption in favor of the relevant thesis, which may be trumped by good arguments against multiple occupancy or material co-location.

¹¹ Bizarre examples abound. Consider the alleged possible material object that occupies every subregion of some galaxy-sized region (with the exception of exactly

attention to a class of considerably more modest candidates, however. As a standard representative of this class, consider a material object that bears this perfectly natural external relation of occupation to a cubical region, S , and also to another cubical region, S^* (where S and S^* do not overlap), and to no other regions. Moreover, let us add that our object is a material simple, and thus fails to be partly located at any region. By hypothesis, this material object is neither located nor partly located at proper subregions of S and S^* , and it also fails to be located at the fusion of S and S^* . Such an object would ensure a negative answer to (Q2).

Material objects of this kind would nevertheless enjoy multiple location. The simples of this species would in one respect be like entending objects (since they would be wholly located at more than one region), but could in another respect be like spanners (for they could in fact be located at a non-point-sized region without also having themselves or their parts located at any of its proper subregions). The composites of this species would in one respect be like entending objects (since they would be located at more than one region), but could in another respect be like pertending objects (since they could be partly located in some regions). So let us add one final definition.

‘ x multiply locates’ \equiv_{df} (i) x is a material object that is located at more than one region, and (ii) x is not located at the fusion of the regions at which x is located.

It is interesting to note that (given our earlier definition of ‘entirely located’) objects that satisfy this definition of ‘multiply located’ are not guaranteed to be entirely located anywhere, since for any region at which they are located there may well be a disjoint region at which they are also located; moreover, other multiply located objects may be entirely located in each of two regions when the regions in question partially overlap. This is one reason why I did not use ‘exactly located’ in place of (or as a stylistic variant on) ‘entirely located’—even if a multiply located object is not entirely located anywhere, one might still think that there is an interesting sense in which it is exactly located. Again, though, I intend both to sidestep the task of attempting to specify this sense and also to continue to avoid the locution ‘exactly located’, as it does no work in the argument of the present chapter. Moreover, it is interesting

one of its Manhattan-shaped subregions) and also occupies a Cantor-dust-shaped region some million light years away.

to note that objects that are multiply located may or may not be partly located at some of the subregions of the regions at which they are located, since they may or may not have proper parts at these subregions—the matter is left open.

For one (perhaps surprising) reason to take the possibility of multiply located objects seriously, see Armstrong (1997) on universals, and then, in addition to presupposing the thesis that universals are located where we find their instances, accept an abundant rather than a sparse theory of universals. On such a conception, ‘being a maximal sphere’ would be multiply located in a world with two maximal spheres (without being located at any of the subregions of the regions they occupy or at their fusion), whereas ‘being a maximal sphere’ would be a spanner in a world with one maximal sphere. Other universals, such as ‘being a connected object’, would be multiply located in a world with two disconnected spheres and (depending on whether the spheres had parts) would be located at many of the subregions of the regions they occupy without being located at their fusion. There are other definable location relations to worry about, but these will do for our purposes.

Some warm-up exercises: consider the relation ‘being bigger than’. Like the relation of multiple location between a single material object and a plurality of regions, a single object can bear ‘being bigger than’ to a plurality of other objects without bearing that relation to their fusion. Consider the relation ‘being the same size as’. Like the relation of spanning between a single material object and a single region, a single object can bear ‘being the same size as’ to a whole without bearing that relation to its proper parts. Consider the relation ‘being the same size as or bigger than’. Like the relation of entending between a single material object and a plurality of regions, a single object can bear ‘being the same size as or bigger than’ to another object and to each of that object’s proper parts (without doing so in virtue of any of its own proper parts). Consider the relation ‘being a composite whose parts are in one–one correspondence with’. Like the relation of pertending between a single material object and a single region, a single object can bear ‘being a composite whose parts are in one–one correspondence with’ to another object (a feature which fixes yet further relations to each of that object’s proper parts, but which does so in virtue of relations obtaining between that object’s proper parts and its own proper parts).

An example may help clarify the differences between these complicated conceptions. Imagine a table on which recently sat four exhibits, labeled 'P', 'E', 'S', and 'M'. To the naked eye, the four exhibits would have appeared remarkably similar . . . each looked like a pair of homogeneous black spheres, equal in diameter, an inch apart from one another. But as you examine the display cards, you read the following:

P: Here sat an instantaneous and spatially scattered pertending object. The region it entirely occupied was a disconnected region best described as the fusion of two spherical regions, equal in diameter and an inch apart. This object was the fusion of two spheres and also the fusion of four hemispheres and also the fusion of uncountably many other pluralities of material objects, many of whose shapes are so remarkable that they have no common names.

E: Here sat an instantaneous and spatially scattered entending object. The region it entirely occupied was a disconnected region best described as the fusion of two spherical regions, equal in diameter and an inch apart. It had no proper parts, for, like all entending objects, it was a non-point-sized simple. It was, however, wholly located at each of the subregions of the disconnected spatial region it occupied.

S: Here sat an instantaneous and spatially scattered spanning object. The one and only region it occupied was a disconnected region best described as the fusion of two spherical regions, equal in diameter and an inch apart. It had no proper parts, for, like all spanners, it was a non-point-sized simple.

M: Here sat an instantaneous and spatially connected multiply located object. One of the two regions it occupied was a spherical region which happened to be an inch apart from the only other region it occupied, which was also spherical and of the same diameter. It had no proper parts, for, like some multiply located objects, it was a non-point-sized simple.¹²

¹² Play along with the conceit that pertending, entending, spanning, and multiply located objects are compossible. You don't really have to endorse it, you know, and insisting otherwise would make an already curious story even more curious. I should note that in here claiming that all entending objects and spanners are simples, I am assuming the impossibility of material co-location, for otherwise the fusion of two co-located spanners would be a composite spanner, and the fusion of two co-located entending objects would be a composite entending object.

Our four objects do share one very clear similarity, in addition to their perceptual indiscernibility. For each object we may identify a scattered region of exactly the same shape and size, every point in which falls within the fusion of the regions occupied by the object. Yet, despite their perceptual indiscernibility and this common relation to points in a certain type of aggregate, the four objects allegedly bear very different location relations to these scattered regions and have very different features. For example, it turns out that only P is a composite object, that only E is wholly located at a hemispherical region, that only S has exactly one location relation without being partly located anywhere, and that only M is an object that fails to be entirely located anywhere.

Now, for what it's worth, I am inclined to the view that P is the only genuinely possible object in the bunch, and that the rest are pretenders.¹³ The opposing voices are impressive and respectable, though, and this is not entirely an exercise in partisan metaphysics. So, with the candidates on the table, let me turn to some puzzles that may help us think about which of them we might consider worthy of endorsing as possible (or, for all we know, as actual).

§3 Extended Simples

Entending, spanning, and multiply located objects would be (or in the case of multiple locators, would occasionally be) non-point-sized or even extended mereological simples. As expected, the pertension theorist is likely to restrict material simples to point-sized material objects. Moreover, if one is also willing to deny the possibility of the co-location of material objects, one may then simply endorse my own favorite analysis of 'material simple' according to which, necessarily, material simples are all and only the point-sized objects.¹⁴ But there are a few

¹³ Although the following is not my reason for suspicion. If the stipulation that the objects are scattered is interfering with your judgments about their possibility, you can glance at the neighboring table whose exhibits are just like those we have described with the exception of looking like a pair of homogeneous black spheres that are equal in diameter and in contact. Connectedness, then, is negotiable.

¹⁴ In favor of this analysis see the Introduction and Hudson 2001*a*, and against this analysis see Markosian 1998 and McDaniel 2004*b*.

long-standing friends of the possibility (and perhaps of the actuality) of extended simples, and the number of their supporters is ever increasing. Philosophers who endorse the possibility of extended simples include John Bigelow (1995), Ned Markosian (1998), Fraser MacBride (1998), Kris McDaniel (2004*b*), Josh Parsons (2004 and unpublished), Ted Sider (unpublished), and Peter Simons (2004). One can also find physicists who apparently endorse the actuality of extended simples, but I can't help but think that this endorsement often arises from confusing the concept of an indivisible object with that of a mereological simple. Whereas having no parts may certainly be one explanation of the indivisibility of a material object—a law of nature prohibiting certain kinds of separation is another, and one that does not immediately license verdicts on mereological structure. It may be the physicist's job, for example, to tell us whether the fundamental entities that physics appeals to are physically indivisible one-dimensional strings, but it is the job of the metaphysician to tell us whether those uncuttable things are composite.¹⁵

Of course, if there were a way to refute the thesis that non-point-sized material simples are possible, then both entension and spanning would be unsatisfiable conceptions, and we would be left with pending objects and multiply located objects that are composite at each of the non-point-sized regions they occupy.¹⁶

So just what are the alleged problems with non-point-sized material simples that promise to threaten entension, spanning, and some forms of multiple location? There are several. Let me begin by introducing and offering a few remarks about three of the difficulties already touched on in the literature (to varying degrees), and then I will turn my attention to a presentation and critical evaluation of a fourth, as yet undiscussed puzzle.

¹⁵ Or, if the pronouncement comes from a physicist, then this is a pronouncement *qua* metaphysician, not *qua* physicist. For an example of this alleged confusion, see Greene 1999.

¹⁶ This, in fact, corresponds to a view called 'Partism' that I introduced and defended in my 2001*a*: ch. 2, a view designed to provide a satisfactory answer to the so-called Problem of the Many. According to the Partist, a material object can be located at two distinct regions without being located at their fusion. When this occurs, however, the material object in question has parts indexed to different regions. Despite its general four-dimensionalist similarities, this solution winds up sharing one alleged cost of orthodox three-dimensionalism, inasmuch as it treats parthood as a three-place relation—albeit the Partist takes parthood to be *region*-indexed rather than *time*-indexed.

§4 The Problem of Spatial Intrinsic

David Lewis (1986) famously posed the problem of temporary intrinsic against the three-dimensionalist who maintains that an object is wholly located at each of the times at which it exists.¹⁷ “If we know what shape is,” says Lewis, “we know it is a property, not a relation” (1986: 204). The problem, it would seem, is that the three-dimensionalist has to treat shapes as relations, not properties. Unfortunately, ‘being straight’ may have been an ill-chosen example of an intrinsic property for Lewis, since there is a very good case to be made for the claim that shapes of material objects should be regarded as extrinsic relations even by the four-dimensionalist (see McDaniel 2004*b*). But the strategy of the objection is clear: three-dimensionalists allegedly cannot accommodate temporary intrinsic properties and this is a fatal defect. I think, nevertheless, that either they can accommodate temporary intrinsic after all, or else the alleged defect is not fatal. The argument can be reasonably resisted; the only question is how best to resist (see Hudson 2001*a* and Sider 2001). Let F be some supposed temporary intrinsic property. Prominent three-dimensionalist replies to the problem of temporary intrinsic have invoked presentism (the doctrine that only present things exist), taking tense seriously (a view that entails that a proposition can change its truth-value across time), adverbialism (the view that an object can bear ‘the having at t ’ relation to F), indexicalism (the view that an object can bear ‘the being F at’ relation to t), or time-indexed properties (the view that an object can have the property F at t).

Now for our worry. Suppose that we have a spatially extended simple. First decision point: must our simple be homogeneous, or could it be heterogeneous (being, say, blue in one region and red in another) and thus present us with an analogue of the three-dimensionalist’s problem, which can be called the problem of spatial intrinsic?¹⁸ One

¹⁷ Incidentally, the debate concerning whether the three-dimensionalist can define ‘wholly present’ so that it is neither trivial nor wedded to mereological essentialism nor parasitic on the notion of a temporal part (see Sider 2001) may be advanced by invoking the difference between entending and multiply locating objects.

¹⁸ I here follow the practice of using ‘blue’ and ‘red’ as placeholders for alleged intrinsic properties, but only because it makes for a vivid and easy to visualize example employing very familiar terms. The problem is in no way wedded to any thesis about the status of color properties.

philosopher, Kris McDaniel, has argued that the problem of spatial intrinsics is fatal to any proposal about heterogeneous spatially extended simples, on the grounds that an object can exemplify the relevant kind of spatial qualitative variation only by having distinct proper parts that exemplify *simpliciter* different intrinsic properties at different regions of space. So, heterogeneous spatially extended simples are ruled out (see McDaniel 2003a, 2004a). McDaniel, though, is willing to back the possibility of homogeneous spatially extended simples with no variation in spatial intrinsics. It is worth noting that McDaniel's combination of views countenances the possibility of some rather remarkable unmarkable creatures; just try to draw a line on one, and you will either fail to do so or else succeed in transforming it into a composite.¹⁹ But other philosophers champion heterogeneous spatially extended simples as well. Let's briefly explore this more liberal thesis.

Second decision point: take a heterogeneous, spatially extended simple, blue in one region and red in another. Now obviously the simple does not have any proper parts that exemplify these properties *simpliciter*, but is there *any* item that exemplifies these properties *simpliciter*? Here one expects a negative response and to see the analogues of the most prominent three-dimensionalist answers surface. Thus, one might hold variants on adverbialism (according to which a spatially extended simple can bear 'the having at spacetime region *s*' relation to being blue), indexicalism (according to which a spatially extended simple can bear 'the being blue at' relation to *s*), or region-indexed properties (according to which a spatially extended simple can have the property being blue at *s*).²⁰ Nevertheless, other philosophers champion heterogeneous spatially extended simples which are such that some item does in fact exemplify *simpliciter* those properties that make for the relevant kind of spatial qualitative variation. Let's briefly explore this more liberal thesis, as well.

¹⁹ A thought worth considering: what of a multiply located simple with no accidental intrinsics? Such a creature could safely inhabit more than one Lewis world in the plenitude of disconnected spacetimes discussed in Lewis 1986 (without being a cross-world fusion with different proper parts in different Lewis worlds), provided that no causal relation could move from an object in world 1 through the putative multiple locator to an object in world 2.

²⁰ My favorite among these options is adverbialism, which has a precedent in Lowe 1988. For a critique of adverbialism see Hawley 2001. I suppose it is worth noting that prospects are not promising for the analogues of presentism or taking tense seriously. I suspect that no one, for example, believes that only spatially present things exist.

Third decision point: take a heterogeneous, spatially extended simple, blue in one region and red in another. Is the item that exemplifies these properties *simpliciter* a material object? One philosopher, Ned Markosian, has argued that not things but portions of stuff exemplify the relevant properties *simpliciter*. Briefly, the idea is that there is a fundamental ontological distinction that separates region-fillers into material objects and material stuff, and that the constitution relation is to be construed as a non-identity relation between an object and some stuff. Moreover, whereas an extended object constituted by some stuff may be mereologically simple (on Markosian's view merely in virtue of being a maximally continuous object), the stuff that constitutes that object will be mereologically complex and will always be able to furnish distinct subportions ready to take on the burden of exemplifying different spatial intrinsics *simpliciter*.²¹ Still other philosophers champion heterogeneous, spatially extended simples which are such that some item does in fact exemplify *simpliciter* those properties that make for the relevant kind of spatial qualitative variation—but not in any way that requires a fundamental mixed ontology of things and stuff. Let's briefly explore this final thesis, as well.

One philosopher, Josh Parsons, has argued that the heterogeneous, spatially extended simple itself is the object that instantiates *simpliciter* the intrinsic properties that make for the relevant qualitative spatial variation. According to this proposal, the intrinsic non-relational property instantiated *simpliciter* by the spatially extended simple is (what Parsons calls) a distributional property—in this case, a color-distributional property. The color distribution of a heterogeneous spatially extended simple guarantees that it will be blue in one region and red in another, but not in virtue of anything or any stuff instantiating blueness or redness *simpliciter*. One advantage of this view (at least according to those who think that space and time are alike in important ways) is that the same strategy can be put forth as a unified response to both the problem of spatial intrinsics and the problem of temporary intrinsics (i.e., to variation across space and to change across time). Parsons campaigns for this ingenious view by arguing that flexibility in one's ontology of spatial and temporal parts is a goal well worth the

²¹ Markosian's views on extended simples can be found in his 1998. For the discussion of the stuff solution characterized above, see his 2004*b*.

ideological price of replacing familiar talk of blueness and redness in terms of color distributions, and of mass in terms of mass distributions, and (in general) of spatial or temporal variation in some property F in terms of a non-uniform F distribution.²²

Perhaps, however, you find all of these suggestions unacceptable. Perhaps you deny either that there are irreducible distributional properties or that they are implicated in the correct analysis of variation or change (against Parsons); and perhaps you reject the fundamental mixed ontology of things and stuff (against Markosian); and perhaps (like Lewis) you refuse the friendly suggestions of adverbialism, indexicalism, and region indexing; and perhaps you deny the brute theory of simples (which McDaniel calls upon when endorsing homogeneous spatially extended simples). In that case you will regard entending and spanning objects as forfeit. But that's a lot to hang on some perhapses. So, here's a second worry.

§5 The Problem of Shapes

Material objects have shapes, by which I will understand their geometrical, topological, and metrical features.²³ It seems quite natural (given substantivalism and the occupation conception of material objects) to think that regions have their shapes intrinsically, and that material objects have their shapes extrinsically insofar as they inherit them from the regions they occupy. Moreover, it also seems quite natural that nothing could have incompatible shapes at the same time. Finally, it would appear that those who believe in the possibility of entending or multiply located objects would regard as possible a single object bearing a location relation to two differently shaped regions. We have some explaining to do.

The pertension theorist faces no embarrassment here, for he may begin by noting that even though a pertending object is partly located at multiple regions, it is entirely located only at a single region, and then

²² Parsons's views on extended simples can be found in his unpublished. For discussion of the distributional property solution characterized above, see his 2004.

²³ In this respect I follow McDaniel 2003*b* in his critical discussion of Barker and Dowe 2003. Accordingly, a cube and a sphere differ in shape, as do an open and a closed sphere of the same diameter, as do two closed spheres of different diameters.

he may maintain that the shape of an object is fixed by the region at which it is entirely located. Similarly, the extension theorist may begin by noting that even though an extending object is wholly located at multiple regions, it is entirely located only at a single region, and thus may also maintain that the shape of an object is fixed by the region at which it is entirely located. Finally, friends of spanning objects have no special problem of shape to address, for spanners are always located at exactly one region.

But the multiple location theorists are in real trouble. They cannot sidestep the problem as can friends of spanning objects, and they cannot simply adopt the proposal advocated by the pertension and extension theorists, for, as noted above, there may be no region at all at which a multiply located object is entirely located (since for any region at which it is located, there may well be another disjoint region at which it is also located). Compare, if you will, the temporal analogue of spatially multiply locating objects, the enduring objects of the three-dimensionalists. The endurance theorist thinks that a baseball has a roughly spherical shape, but this is not the shape of the unique spacetime region which is the fusion of those regions at which it is located. Sphericity is merely its shape at each of the three-dimensional spacelike hyperplanes of the four-dimensional region across which it persists. In an attempt to recommend a solution to this problem on behalf of the multiple location theorists, Kris McDaniel (2003*b*) has suggested that we should distinguish between two ways of having a shape: intrinsically (when an object has its shape in virtue of the way it is in itself) and extrinsically (when an object has its shape in virtue of the way it relates to the regions it occupies). Seen against the backdrop of the enduring objects of the three-dimensionalists, McDaniel's proposal is that the baseball is roughly spherical intrinsically (since that is the way it is in itself) and roughly the four-dimensional analogue of a cylinder extrinsically (since that is the region of spacetime it fills). Contradiction avoided. I part company with McDaniel here, however, for (i) I am not sure what it means to say that an object has its shape in virtue of the way it is in itself, and (ii) I do not think that the theorists in question should agree that the baseball is in fact located at that four-dimensional region. Remember that, as characterized above, multiply locating objects can be located at a plurality of regions without being located at their fusion. I don't mean to deny that there is a unique spacetime region which is the fusion

of all of the regions at which the baseball is located, and I don't mean to deny that this region has the 4D-cylinder shape; it's just that the baseball doesn't inherit this shape from that region, since the baseball simply doesn't occupy that region.

Now, even if Markosian's fundamental mixed ontology of things and stuff provided a way out of the problem of spatial intrinsics, it doesn't seem to do double duty for the problem of shapes facing a multiple location theorist. Otherwise we would have to accept the claim that two distinct portions of stuff each constitute one and the same object. Here it looks as if distributional properties, adverbialism, indexicalism, region indexing, or insisting on an unpalatable homogeneity restriction on the relevant regions are the only options for a resolution. Hence, if appealing to stuff was your only acceptable way out of the problem of spatial intrinsics, then this new problem of shapes should move you to a negative verdict on the possibility of multiple locators. But perhaps you found yourself originally satisfied with a solution that did not appeal to stuff. So, here's a third worry.

§6 The Problem of Parsimony

Consider a possible world with exactly one material object whose only inhabitant is located in more than one region. Such a thing would not be a pertending object, owing to the 'exactly one material object' restriction, but neither would it be a spanner, owing to the 'more than one region' permission. Such an object would either entend or multiply locate; the difference being marked by whether or not the object is located at the fusion of the regions at which it is located.

But once we countenance this possibility, what further restrictions shall we impose? On the one hand, could an entending object be a connected simple in the shape of a chair, or maybe a scattered simple in the shape of an entire dining set, or (why be modest?) even a scattered simple which looks just like a replica of Heidelberg castle with all of its furnishings? On the other hand, could a multiply located object be a simple simultaneously appearing in some 10^{28} distinct regions and entering into various spatio-temporal relations with itself, resulting in what appears to be a particle-for-particle duplicate of a polar bear? (Note that this would promise a genuinely new solution to the so-called

Problem of the Many! A human person would be a material simple, after all, just multiply located.²⁴ Or better yet, could a multiply located simple be simultaneously located at each of some 10^{80} distinct regions and repeat this trick uncountably many times over a 15–20 billion-year interval, all the while entering into various spatio-temporal relations with itself, resulting in what appears to be a particle-for-particle duplicate of the actual world from the time of the big bang to the present moment? Indeed, if this is possible, what should prevent the multiple location theorist (or the extension theorist who can consider its extension analogue) from thinking that this is in fact the proper description of the actual world? A principle of entity parsimony employed as an ontological grim reaper could pare down our apparent plurality of material objects to a single, simple material thing wholly located at exactly those places where a pertension theorist (like me) believes the world contains a point-sized part of a pertending object.

I suppose the following reasoning is a bit too quick: if entending or multiply locating objects were possible, then the exotic items described above would be possible as well. But we should choose the simplest theory from among all those competitors that are equal in explanatory and predictive power, and in the present market this methodology would yield the conclusion that the world is populated by a single simple bearing an uncountable number of occupation relations to distinct regions. But since that verdict is absurd, entending and multiply located objects are not possible, after all.

It *is* too quick... but perhaps resisting the reasoning will tell us something worthwhile about just what theories might need to be joined to those of extension and multiple location. One way to resist would be to invoke a controversial theory about material objects that would guarantee that our world is home to more than one. In the spirit of this proposal, one could follow the extension theorist Ned Markosian, both in accepting heterogeneous entending simples and also in maintaining that the material simples are all and only the maximally continuous objects. Then, since the fusion of all the occupied regions in the

²⁴ For an introduction to this intriguing problem and critical evaluation of eleven proposed solutions, see my 2001*a*: chs. 1, 2.

actual world is not a connected region, it would follow that there exists more than one material object (indeed, given the actual distribution of filled regions, there would be many many more than one).²⁵ Another way to resist would be to invoke a different selection principle among theories tied for empirical adequacy. In pursuing this strategy, one could follow the extension theorist Josh Parsons in maintaining that complications ensuing from translating the pronouncements of standard physics into the language of distributional properties, together with the need for apparently *ad hoc* rules governing transitions over time, would count significantly against the plausibility of the view that our world contains but one material object.²⁶

However these difficulties get sorted out by the extension theorists, the multiple location theorists must address still further concerns. Suppose that in answering the problem of shapes discussed in the previous section, these theorists insist (on what seems to me a gratuitous restriction) that multiple location occurs only when the regions at which the object is located are of the same shape (i.e., have the same geometrical, topological, and metrical properties). But even with this restriction in force, we could still have what looks like our particle-for-particle duplicate of a polar bear to contend with (i.e., corresponding to each region at which a this-worldly polar bear has a particle, we will find one of the many subregions of the region apparently containing our *doppelgänger* bear at which a single simple is multiply located). What properties would this simple (masquerading as a composite) exemplify? As a warm-up exercise, note that you could sit on what looks like a particle-for-particle duplicate of a chair even if it turned out to be but one multiply located simple in disguise—either manifesting a non-uniform distributional mass property or else bearing a number of region-indexed instantiation relations to different masses. The precedent for multiply

²⁵ Markosian 1998. It's not a foolproof solution, though. I suppose one might entertain the epistemic possibility that all the apparently scattered material objects are actually connected by continuous threads that trace out paths through hyperspace, and that we do have one big connected simple after all. But let's agree to set this contingency aside for now.

²⁶ Parsons, unpublished. This excellent and delightful paper contains the only discussion of this intriguing problem I can find in the literature (and that confined to a few suggestive paragraphs). I must say, though, that Parsons's complaints of complexity and arbitrariness strike me as less than decisive (especially since Parsons himself elsewhere advocates denuding our ontology of spatial and temporal parts at the expense of increasing the complexity of our properties). See Parsons 2004.

located simples exemplifying features ordinarily thought to be reserved for composites is thus in place. So, once again, which properties would our multiply located simple exemplify? Would our simple be a polar bear? Would our *doppelgänger* bear be conscious? Again, though, I am less interested in fixing and evaluating answers to these peculiar inquiries than I am in highlighting the fact that a commitment to the possibility of extension or multiple location might require substantially more controversial methodology and metaphysics than one might have suspected.

§7 The Problem of Diachoric Identity

Finally, let us turn to the puzzle in the title of this chapter. A great deal of thought and effort have been lavished on the so-called problem of identity over time and on the task of properly formulating a criterion of diachronic identity (where ‘criterion’ is taken in its constitutive sense and not its epistemic one). Such a criterion would exhibit necessary and sufficient and illuminating conditions on a single thing’s being located at more than one temporal region and traditionally takes the following form:

Necessarily (for any distinct times, t and t^* , and for any object, x , that is located at t , and for any object, y , that is located at t^* , $x = y$ if and only if—).

If we countenance the possibility of (instantaneous) entending or multiply located simples, however, we will also have to confront what we might call the ‘problem of identity over space’ and its associated task of properly formulating a criterion of (synchronic) diachoric identity. Such a criterion would exhibit necessary and sufficient and illuminating conditions on a single thing’s being simultaneously located at more than one spatial region and (if modeled on its counterpart above) would take the following form:

Necessarily (for any time, t , and for any distinct spatial regions, r and r^* , and for any object, x , that at t is located at r , and for any object, y , that at t is located at r^* , $x = y$ if and only if—).

A quick remark about the locution ‘ x at t is located at r ’: I have thus far let my variables, r and r^* , range indiscriminately over temporal regions, spatial regions, and spacetime regions, letting context sort out which was which. I now want to focus on a problem which is most clear

when we confine ourselves to a single time. If ordinary objects persist in virtue of having different temporal parts at different times (the four-dimensionalist view), then I now intend to talk about momentary temporal slices of ordinary objects. If ordinary objects are themselves instantaneous stages which are nevertheless said to persist by bearing a temporal counterpart relation to numerically distinct objects (the stage view), then I now intend to talk about these instantaneous items. If ordinary objects persist by being wholly located at each of the times at which they are located (the so-called three-dimensionalist view), then my talk about the spatial locations of such an object should now be understood as confined to its spatial locations at a single time.²⁷

How shall we proceed? We could hope to take a lesson from the literature on the question of how best to formulate a criterion of diachronic identity to see what strategies might carry over to our new problem. On a first pass, there are those who hold that criteria of identity are kind-relative, those who hold that (regardless of kinds) there are no criteria of identity over time for any object, and those who hold that (regardless of kinds) there are criteria of identity over time for every object.²⁸

Consider, first, the kind-relative approach to providing criteria of identity. The proposal is to analyze what it is to be an instance of some given kind, *K* (or perhaps to analyze the concept of a *K*)—on the presumption that such analysis will reveal the identity conditions of a *K*. Presumably, though, not every kind is associated with its own criteria of identity (e.g., ‘being a thing which moves’ may not be a relevant kind); perhaps only natural kinds have this distinction.²⁹ A serious objection to this approach rests on the contention that whereas analyzing what it is to be an instance of some given kind *K* (or analyzing the concept of a *K*) might tell us a great deal about the essential features of any *K*, this does not entail anything as rich as necessary and sufficient and illuminating conditions for being a *K*.³⁰ Whether or not this line of

²⁷ On four-dimensionalism, the stage view, and three-dimensionalism, see Sider’s excellent 2001. For an unorthodox cousin of four-dimensionalism (which is something of a combination of four-dimensionalist and three-dimensionalist themes), see my 2001*a*: ch. 2.

²⁸ See Lowe 1989 for an instance of the first, Merricks 1998 for an instance of the second, and the discussion below for a defense of the third.

²⁹ On this point, see the discussion of locomotors in Olson 1997.

³⁰ Merricks 1998 contains a sustained defense of this objection.

criticism is correct, though, it does seem clear that analyzing what it is to be an instance of some given kind K (or analyzing the concept of a K) will not tell us what it takes for a K to persist over time. Moreover, if 'being of kind K ' doesn't fix what it takes to persist across time, it has even less hope of determining what it takes to extend across space at a time. Accordingly, appeal to kind-relative criteria of identity would appear to be of little value in properly formulating a criterion for diachoric identity.

Consider, second, the claim that (regardless of kinds) there are criteria of identity over time for every object. I think this is true, but I believe that its defense depends on the four-dimensionalist's controversial metaphysical claim that material objects persist in virtue of having different temporal parts at different times. Such a four-dimensionalist will presumably wish to reject the schema for formulating the criterion of diachronic identity given above on the grounds that, strictly speaking, no object is located at two distinct times. Given our earlier definitions, however, an object may be partly located at two distinct times. Thus the task of formulating a criterion of diachronic identity will be replaced by the task of stating gen-identity conditions on temporal parts:

Necessarily (for any distinct times, t and t^* , and for any object, x , that is located at t , and for any object, y , that is located at t^* , x is a temporal part of the same object as y if and only if—).

Filling in the blank will be a matter of what theory of composition is true. My own preference is universalism—the doctrine that any plurality of objects has a mereological sum, a view that would simply fill in the blank with 'x and y exist'. Alternatively, one might argue for a restricted theory of cross-time fusions, according to which there must also be certain causal relations between two objects in order for them to stand in the 'temporal parts of one and the same persisting object' relation. Although I accept that causal relations are a necessary condition on successive temporal parts of ordinary objects such as chairs, persons, and statues, I take 'material object' to be a more liberal sortal than 'chair', 'person', or 'statue'. Accordingly, that there are two material objects confined to different temporal regions is always sufficient for the existence of some persisting material object, even if it fails to satisfy any familiar sortal and even if it moves discontinuously and faster

than light.³¹ As I see it, then, once characterized as a problem of formulating a gen-identity relation, the problem of diachronic identity is solved by the four-dimensionalist universalist.

So, how does this help with our new puzzle? Well, it points to a straightforward solution for the friends of pertending objects. For these theorists, the problem of diachoric identity can be resolved in a perfectly analogous manner. Our pertension theorist will similarly begin by rejecting the schema for formulating the criterion of diachoric identity given above on the grounds that, strictly speaking, no object is located at two distinct spatial regions. Given our earlier definitions, however, an object may be partly located at two distinct spatial regions. Thus the task of formulating a criterion of diachoric identity will be replaced by the task of stating gen-identity conditions on spatial parts:

Necessarily (for any time, t , and for any distinct spatial regions, r and r^* , and for any object, x , that at t is located at r , and for any object, y , that at t is located at r^* , x is a spatial part of the same object as y if and only if——).

Once again, filling in the blank will be a matter of what theory of composition is true, and as we have seen, universalism will direct us simply to fill in the blank with “ x and y exist”. Significantly, the alleged causal restriction on diachronic composition has no analogue here, for the items in question are instantaneous and space-like separated, and such a restriction would here yield an implausible compositional nihilism. As I see it, then, once characterized as a problem of formulating a gen-identity relation, the problem of diachoric identity is solved by the pertension theorist who is also a universalist.

But what of our simple entending and multiply located objects? Since these items allegedly can be simultaneously located at distinct spatial regions, it would appear that we would have to revert to the original way of posing the problem—“How shall we fill in the blank?”

Necessarily (for any time, t , and for any distinct spatial regions, r and r^* , and for any object, x , that at t is located at r , and for any object, y , that at t is located at r^* , $x = y$ if and only if——).

Curiously, one friend of entending objects can borrow the pertension theorist’s solution without embracing his metaphysics. Recall Ned

³¹ For elaboration and defense of this (perhaps surprising) claim see Ch. 5 below.

Markosian's mixed ontology of things and stuff. On Markosian's view, entending objects are always constituted by a composite portion of stuff. Since Markosian is a compositional universalist when it comes to portions of stuff, he may employ the following strategy. First, endorse a ban on the possibility of material co-location (e.g., ruling out a co-located statue/lump pair). Then give the gen-identity conditions on spatial parts of portions of stuff by mimicking the pertension theorist above. Finally, fill in the blank with "*x* is constituted by the same portion of stuff as *y*". The distributional property and adverbialist friends of entending objects, however, have no analogous way to fill in the blank. And this seems also to be the predicament of the distributional property and adverbialist and mixed ontologist friends of simple multiply located objects. None of these theorists is in a position to appeal to parts of objects (or to the proxy parts of stuff) to transform the problem into a question about gen-identity (the strategy being blocked for the stuff theorist in the case of multiple locators for the reasons noted above).

Moreover, any appeal to analyses of 'being of kind *K*' (or to the concept of a *K*) for the relevant kinds—whatever they might be—simply won't fix what it takes for a *K* to extend across space at a time. Of course, one could easily (and even trivially) supply necessary and sufficient conditions, but unless these were also informative (i.e., did not presuppose the very identity claims at issue), they would fall short of providing a criterion.

One final tactic that deserves brief mention suggests itself. Consider the following strategy. Begin, once again, with a ban on the possibility of material co-location. Then, whereas the friends of entending objects may fill in the blank with "*x* is entirely located at exactly the same region as *y*", the friends of multiply located objects may fill in the blank with "*x* is located at exactly the same plurality of regions as *y*", a strategy which could be adapted to provide a criterion of diachronic identity, as well. Unfortunately, the ban on the possibility of material co-location is certainly not as popular as it once was. Moreover, it is worth remarking that, insofar as they share a ban on material co-location, both this strategy and the strategy available to the mixed ontologist would eliminate any special motivation for entension and multiple location which arises from certain views regarding singletons and universals being co-

located with their elements and instances.³² Similarly, insofar as extension and multiple location theorists gain support for their views by appealing to the suggestion that occupation may be a one-many relation, they will make it that much harder to avail themselves of the present strategy, since this suggestion seems equally to support material co-location. Accordingly, such theorists may well do best to follow Trenton Merricks and maintain anti-criterialism with respect to the alleged criterion of diachoric identity for entending objects and for multiple locators.³³

§8 Scores

On pertending objects. The pertension theorist has immediate and automatic (and to my mind perfectly satisfactory) answers to the problem of spatial intrinsics, the problem of shapes, the problem of parsimony, and the problem of diachoric identity.

On entending objects. The extension theorist who is either a distributional property theorist or an adverbialist or a homogeneity-only theorist has resources to confront the problem of spatial intrinsics and the problem of shapes, but has a considerably less clear solution to the problem of parsimony and the problem of diachoric identity (although those willing to ban material co-location may have something to say about the latter). The extension theorist who bans material co-location and who is a proponent of a mixed ontology of things and stuff has resources to confront all four problems, but pays a price in controversial claims about ontology, material simples, and composition.

On spanners. The friend of spanning objects who is either a distributional property theorist or an adverbialist or a homogeneity-only theorist or a proponent of a mixed ontology of things and stuff has resources to confront the problem of spatial intrinsics, but pays a

³² Of course, one might simply deny—against the occupation conception—that bearing a location relation to a region is sufficient for being a material object, and thereby attempt to avoid any commitment to co-location of material things.

³³ Where ‘criterialism’ is just the view that there are criteria of diachoric identity. Just to be clear, I regard this as a disadvantage (despite Merricks’s spirited defense of diachronic anti-criterialism in his 1998).

price either in one or another controversial claim about properties or else in controversial claims about ontology, material simples, and composition. (Since they all exploit an object's being located in more than one region, the other three problems simply don't arise for spanners which by definition enjoy exactly one location relation.)

On multiply located objects. The multiple location theorist who is either a distributional property theorist or an adverbialist or a homogeneity-only theorist has resources to confront the problem of spatial intrinsics and the problem of shapes, but has a considerably less clear solution to the problem of parsimony and the problem of diachoric identity (although, once again, those willing to ban material co-location may have something to say about the latter). The multiple location theorist who is a proponent of a mixed ontology of things and stuff has resources to confront the problem of spatial intrinsics and the problem of parsimony, but has a considerably less clear solution to the problem of shapes and the problem of diachoric identity.

As I see it, then, (i) the only theorist in a position to countenance the possibility of (instantaneous) entending objects is the proponent of a mixed ontology of things and stuff; (ii) distributional property theorists, adverbialists, homogeneity-only theorists, and proponents of a mixed ontology of things and stuff are all in a position to countenance the possibility of (instantaneous) spanners; and (iii) assuming criterialism (i.e., that there are in fact criteria of diachoric identity), no one is yet in a position to countenance the possibility of (instantaneous) multiply located objects.³⁴

³⁴ Once again, though, I have elsewhere introduced and defended a version of multiple location in which the object occupies multiple regions that overlap and in which the object is not simple but rather composite at each of the regions it occupies. And again, when this occurs, the material object in question has parts indexed to different regions. Questions concerning diachoric identity appear in that context as well and are briefly discussed under the title 'diageometric identity' in my 2001*a*: ch. 4, sect. 5. But the presuppositions of that discussion are much more constrained than they are here, and this leads to an investigation rather different from the one we have just completed.

5

Superluminal Motion and Superluminal Causation

§1 Moving Faster than Light

In Chapter 1, I critically evaluated a popular argument for substantivalism, in the course of which I speculated about a human hand persisting through a rather unusual change of location, a change arising from the sudden and discontinuous jump of the particles which compose it to their respective positions in its reflective mapping. One serious reason to object to this suggestion involves the twofold complaint that (i) such a scenario would involve superluminal motion for a human hand, and (ii) nothing moves faster than light. Another serious reason to object to this suggestion involves the further twofold complaint that (i) such a scenario would involve superluminal causation, and (ii) no causal signal moves faster than light. In this chapter, I will have something to say about the alleged universal ban on superluminal motion, and something further to say about the alleged universal ban on superluminal causation.

Any schoolchild will tell you that nothing moves faster than light. Perhaps some of the clever ones will tell you that something once moved faster than light—but that was just at the earliest of times when (allegedly) light moved faster than it does now. Notwithstanding this cloud of witnesses, in the brief discussion that follows I would like to offer a reason to think that not only are there material objects that move faster than light, but also that for any multiple of the speed of light you might care to specify, there are material objects that move at that speed (managing to accomplish this feat without engaging in discontinuous motion).

Let ‘Cone’ name a (closed) section of a cone which has a lifespan of an hour and whose height from base to top is roughly two feet (less

roughly, whose height from base to top is just a quib over two-billionths of a light-second). A quib, you should know, is exactly one-billionth of a billionth of a light-second in length. Non-denumerably many two-dimensional, circular discs cut Cone heightwise. Call the set whose members are all and only such discs ‘the Disc Set’, and note that for any two discs in this set, one has a smaller diameter than the other. I hasten to add that I don’t believe that there exist any non-scattered solids this large, but the selected shape and size simply serve to make the case intuitive and vivid. Let me acknowledge, however, that in accordance with the doctrine of arbitrary undetached parts, I am here presupposing that at least one such n -dimensional object has a full complement of $n-1$ -dimensional, cross-sectional, spatial parts—and popular as it may be, that’s a genuinely controversial assumption.

Let ‘T’ name an extended, connected, closed interval of time that has a temporal measure of precisely one-billionth of a second plus one-billionth of a billionth of a second more, and which elapses during Cone’s lifespan. Non-denumerably many instants are found in T. Call the set whose members are all and only those instants ‘the T Set’, and note that for any two instants in this set, one is earlier than the other.

The members of the Disc Set can be put into a one–one correspondence with the members of the T Set. Suppose we assign partners as follows: let the disc with the largest diameter be assigned to the earliest of the instants, and further ensure that for any two discs, if the first is larger than the second, then it is assigned to an earlier instant than the second.

Cone is a composite object. Each of the discs in the Disc Set is a part of Cone. Each of the discs, in turn, has parts. Let the t -part of an object be the instantaneous temporal part of that object that exists at t . Accordingly, each of the discs in the Disc Set has non-denumerably many t -parts which cut the disc along its temporal extension.

Let ‘the Quick Set’ name the set whose membership is determined as follows. For each disc in the Disc Set, d , if t is the time in the T Set to which d has been assigned in our pairing above, then let the t -part of d be a member of the Quick Set. Accordingly, each disc in the Disc Set contributes exactly one instantaneous temporal part to the membership of the Quick Set.

Let ‘Quick’ name the fusion of the members of the Quick Set. Quick is a material object with a lifespan of exactly one-billionth of a second

plus one-billionth of a billionth of a second more, and at every moment of Quick's lifespan, Quick is extended in two spatial dimensions and is located without being extended in the third. At every instant in T , Quick exactly occupies a different region of space. Thus (on what can reasonably be called an orthodox view) Quick is an object in motion. Moreover, for every extended, connected subinterval of T , t^* , Quick sweeps out an extended, connected interval of space during t^* —i.e., Quick is never in discontinuous motion.

Quick is quick! Quick travels from the base to the top of Cone at roughly twice the speed of light, for whereas light traverses that distance in just over two-billionths of a second, Quick takes the trip in just over one-billionth of a second.

Note that we could have selected even shorter extended intervals in our thought-experiment; our T could have been as brief as you please. Accordingly, we could have identified objects that traveled at n times the speed of light for any natural number, n , we might like to select. Still, one may be troubled that Quick is really only a three-dimensional object (counting once for its temporal extension), since at each moment of its existence it is extended in only two spatial dimensions. Perhaps it would be better if we could also find a relative of Quick which was just as fast and which occupied a volume at each moment of its existence.

Let 'ThickQuick' name such a relative. Here are its salient features: ThickQuick is a material object with the lifespan of exactly one-billionth of a second, and at every moment of ThickQuick's lifespan, ThickQuick is one quib high (if you've forgotten about quibs, see the third paragraph of this chapter). At every instant of its existence, ThickQuick exactly occupies a different region of space, and for every extended, connected subinterval of its lifespan, t^* , ThickQuick sweeps out an extended, connected interval of space during t^* —i.e., ThickQuick is never in discontinuous motion. Here is how you may locate ThickQuick during T : find the disc, D , that cuts Cone at the one-quib mark above its base. (Hint: look exactly one-billionth of a billionth of a light-second in height above Cone's base.) Now find the moment, M , we earlier paired with D above. (Hint: on the assumption that we took care to ensure that our original pairings preserved a constant traveling speed for Quick, then you should look exactly one-billionth of a billionth of a second after the beginning of the interval T .) Now, M is the first instant of ThickQuick's lifespan, and at M ThickQuick is

bounded by the M-part of D and extends exactly one quib towards the base of Cone. Moreover, for every time later than M in T, t^* , at t^* ThickQuick is bounded by the t^* -part of whichever disc we earlier paired with t^* , and extends exactly one quib towards the base of Cone. Despite dragging a tail behind him, ThickQuick moves at twice the speed of light and always occupies a volume.

Quick and ThickQuick come from a large family. It is an easy task to identify even more of their relatives. Accordingly, I conclude that if the controversial (but quite popular) metaphysical assumptions just invoked are true (I, at least, accept them), then for any multiple of the speed of light you might care to specify, there are plenty of material objects that move at that speed.

§2 Immanent Causality and Diachronic Composition

But isn't this outlandish? After all, Special Relativity is widely believed to have the consequence that

(1) No material object moves faster than light.

More cautious formulations of the alleged restriction are frequently supported, however, and in the literature one often finds some version or abbreviation of the thesis that Special Relativity implies that

(2) There is no superluminal propagation of matter, energy, signals, or causal influence.

Significantly, these are non-equivalent claims, and the physics community is not in uniform agreement about just which combination of these theses Special Relativity counsels us to endorse.¹

In the preceding section, I proposed a challenge to the truth of (1)—a challenge arising not from results in contemporary physics, but rather from a priori reflection on parthood, persistence, and motion. In brief, when one adopts

(3) the doctrine of arbitrary undetached parts

(4) four-dimensionalism

(5) universalism

and a (highly intuitive) sufficient condition for motion,

¹ For a presentation and intriguing discussion of the distinctions between the alternatives mentioned in (2), see Maudlin 2002.

(MO): Necessarily (a material object, x , is in motion during an extended interval t , if (i) at every instant in t , x occupies a region of space; and (ii) at no two instants in t does x occupy the same region of space),

then (as we have just seen) one may construct an argument for the claim that for any multiple of the speed of light you might care to specify, there are plenty of material objects that move at that speed.²

Since this contradicts (1), we are under some pressure either to deny Special Relativity or else to deny that it implies (1). Notwithstanding whatever credentials it might eventually furnish for (2), I am among those who deny that Special Relativity implies (1).

There are, of course, several ways to contest my argument. One can complain that my 'Quick' does not name a material object (perhaps by denying one or more of (3), (4), and (5) above), or one can agree that Quick is a material object but deny that it is in motion (perhaps by denying (MO) above), or one can agree that Quick is a material object in motion but deny that it is in superluminal motion (perhaps by arguing that if it were, then (2) would also be violated, and that this would unacceptably conflict with Special Relativity).

In his recent stimulating and challenging paper, Yuri Balashov (2003*a*) takes the first of these approaches by maintaining that I have not managed to identify a genuine material object after all, and in so doing gives voice to what I believe is the most popular reaction to the argument of section 1. However, since he accepts the central conditional of my argument, his *modus tollens* leads him to reject one of the components of its antecedent—universalism.

(Universalism): Necessarily, for any objects, the x s, there exists an object, y , such that the x s compose y .

In particular, Balashov proposes a restriction on diachronic fusions "cast in terms of immanent causality or gen-identity" between the temporal parts of some given material object.³ I think it may be better to proceed with 'immanent causality' rather than 'gen-identity', for the standard meaning of 'gen-identity (with respect to F)' is just the trivial relation

² Perhaps it is worth noting that non-modally qualified and relativistically sensitive principles—which are considerably more modest than (3), (4), and (5) in yet other respects—would drive the argument just as well, but I am happy to work with the full-strength versions, which I endorse.

³ Recall (from the Introduction) our definition: ' x is an instantaneous temporal part of y at instant t ' =_{df} (i) x is a part of y ; (ii) x is present at, but only at, t ; and (iii) x overlaps every part of y that is present at t .

induced among certain temporal parts in virtue of their being stages of one and the same *F*. Admittedly, the *analysis* of ‘gen-identity (with respect to *F*)’ for almost every interesting substitution on ‘*F*’ (e.g., ‘person’) requires some sort of immanent causal relation between successive stages. But the crux of the present debate concerns whether it is true that every persisting material object has temporal parts that are connected by immanent causation. If Quick is a material object, then this thesis is not true. So, in the interests of not stacking the deck against myself, I will not treat ‘related by gen-identity’ and ‘related by immanent causation’ as (even loose) synonyms in the discussion. Even so, I suspect that many philosophers and physicists will feel the intuitive pull of the proposal to restrict diachronic composition by appeal to immanent causal relations between temporal parts. But how, exactly, shall we state the restriction? Perhaps like this:

(R1): Necessarily, for any material objects, the *x*s, there exists a material object, *y*, such that the *x*s compose *y* only if the *x*s are pairwise causally related.

Although it would rule out Quick, (R1) is much too strong. Note that it would have unwelcome consequences, for it would eliminate such things as an instantaneous temporal part of a human person—an item some of whose spatially scattered proper parts fail to stand in any causal relation at the one and only moment of their existence. To be fair, Balashov is clear that he intends only a restriction on diachronic fusions, but it is worth pausing a moment to note that some motivation for the proposal is forfeited once we realize that we are targeting and restricting only a select group of fusions rather than proposing a principle on composition in general. Accordingly, then, we might state the restriction like this:

(R2): Necessarily, for any material objects, the *x*s, there exists a material object, *y*, such that the *x*s compose *y* only if *y*’s temporal parts are immanently causally interrelated.

Like its predecessor, (R2) will remove Quick from our ontology of material objects. But (R2) is problematic, as well. Consider two instantaneous temporal parts of a human person—each a momentary person-stage: now to say that these two person-stages are immanently causally related is to say that there is a certain type and degree of causal dependence of the one upon the other. So far, so good. But as with

other plausible restrictions on composition, a restriction in terms of ‘immanent causality interrelatedness’ invokes a vague term (namely, *that one*), and consequently there can be borderline cases of its application. The bad news for those who reject epistemicism as their theory of vagueness and who agree that so-called ontological vagueness is impossible is that this restriction will compel them to countenance indeterminacy in composition, identity, and existence (i.e., in those areas where the diagnosis of semantic indecision and the leading medicine prescribed by the champions of linguistic vagueness—the method of supervaluations—are wrong and useless, respectively). To rehearse briefly the argument as introduced and advocated by David Lewis, (1986: 212–13), Pretend that there is some restriction on composition. But any restriction would be either grossly implausible or vague. Let us insist that we may safely ignore the grossly implausible answers. That leaves vague restrictions. But there cannot be a vague restriction on composition, for (contrary to fact) if there were, then it would be possible that it is indeterminate whether or not a certain composite object exists. And that is unintelligible. Consequently, composition is unrestricted, after all.⁴ Moreover, not only can we level the charge against (R2) of imposing a vague restriction, but we may continue to press the charge of arbitrariness, as well. Why think that objects would have to stand in causal relations to enter into composition relations across time, but not across space? Indeed, such a restriction seems especially arbitrary in a relativistic setting, where so-called objective distinctions between time and space are compromised.⁵

It might seem, however, that we simply have to eliminate vagueness when formulating the restriction in order to deal effectively with these difficulties—perhaps by trading off vague talk of degrees of immanent causality interrelatedness for more precise concepts not admitting of degree. What, then, if we state the restriction as follows?

(R3): Necessarily, for any material objects, the x s, there exists a material object, y , such that the x s compose y only if the x s are pairwise time-like separated (alternatively, only if for any pair of the x s, x_1 and x_2 , x_1 lies entirely within the light cone centered on x_2).

⁴ I do not endorse this response from vagueness, since my epistemicism is in conflict with it. Epistemicism is such a minority view, however, that I suspect that the response will be of interest to others in search of a reason to reject (R2).

⁵ Thanks to Michael Rea for the substance of these last two sentences.

Vagueness is thereby eliminated, provided ‘time-like separated’ or ‘lies entirely within the light cone centered on’ are precise (and I suppose that’s a defensible assumption). But in gaining the advantage over (R2), (R3) appears to become vulnerable to the objection that undermined (R1); for, like its ancestor, (R3) rules out an instantaneous temporal part of a human person—an item which always sports a pair of scattered and instantaneous proper parts that are space-like separated. Moreover, those in sympathy with Balashov’s proposed ontological distinction should be inclined to reject (R3) directly; for, in letting various subluminal but nevertheless causally disconnected material objects back on our lists of what exists, it wouldn’t have performed properly the job for which it was designed.

Despite what is very likely a widespread inclination to constrain diachronic fusions in some manner that will ban Quick and his brethren, I suspect that formulating a precise restriction—one that can avoid ontological vagueness without sacrificing the instantaneous temporal parts of the objects of our everyday ontology—will be a difficult chore and will yield at best an inelegant and suspect principle still dogged by the charge of arbitrariness.

Here’s an example of such inelegance at work. Take as an unargued-for starting point that there exists an instantaneous, spatially scattered, temporal part of me now (=T)—a stage whose momentary proper parts bear no causal relation to one another whatsoever. Now consider the region of space that this stage exactly occupies at T: namely, S. Now consider the class of all the point-sized proper subregions of S: namely, C. Then we might propose that any other instantaneous, spatially scattered, and non-causally interconnected material object is another temporal part of me only if all of its proper parts fall entirely within the union of the regions described by the light cones centered on each of the elements of C.

Before we embark on revisions of this or even more elaborate formulations, however, we might reassess the need to restrict at all. Do we really challenge anything sacred in maintaining that there are various material objects in superluminal motion? The common assumption that the relevant laws must govern all things material might owe a great deal to the fact that they govern those material objects we happen to care about and have familiar sortal terms for classifying, and to our unfortunate tendency to let our interests and our language drive our ontology.

Let us christen those objects that already satisfy the restriction that Balashov envisions ‘proper continuants’. We need not feel any compulsion to assign this restriction the role of ontological watchdog when we can assign it the less dramatic role of dividing the proper continuants from the ill-behaved ones, though. Moreover, one can further downplay the shocking result of countenancing material objects that are not confined to subluminal speeds and that have temporal parts that are not causally interconnected in familiar ways by observing that these apparent outlaws always decompose without remainder into objects that are law-governed. Fixing the facts about the lawful group always fixes the facts about the lawless group. And finally, the other alleged implications of Special Relativity (i.e., (2) above) are in no danger from these harmless items.

So why insist on calling them ‘material objects’? Well, they still qualify under my occupancy account of material objects (i.e., if they exist, they are concrete individuals, located in space and time... it certainly seems like the best label; what else might they be?). If so, then ‘material object’ would be a more liberal sortal than ‘human person’ or ‘proper continuant’, since the analysis of the gen-identity relation for material objects would not require immanent causal relations between successive stages. Instead, some material objects would be the proper continuants, and others—certain fusions of various parts of the former—would be the exotic ones.

§3 Superluminal Causation

Even if one was convinced that Quick was a superluminal traveler, one might object that this admission provides little support for the claim that a human hand could survive discontinuous movement on the grounds that, in order for something to qualify as a hand (rather than as a hand-shaped material object), its temporal parts must be immanently causally interrelated. But this requires superluminal causation as well as superluminal motion. Since the existence of Quick poses no threat to a ban on superluminal causation, it would seem that this objection is still on the table.

I would now like to discuss briefly five different strategies for thwarting the alleged ban on superluminal causation, two of them invoking

the thesis of hyperspace and none of them turning on some controversy in contemporary physics.

First, suppose that the thesis of a plenitudinous hyperspace is true. Then, if it is nomologically possible for an object to leave our three-space, enter a neighboring region where light travels faster than it does locally, go on a near-light-speed trip, and reenter our own three-space at some distant location, then the object could travel from one point in our three-space to another point in our three-space faster than light could make the trip (provided that the light was not permitted to leave the local three-space, as well). In one perfectly good sense, then, such travel would count as superluminal motion, and since it could also carry a causal signal, as superluminal causation.

Second, suppose that the thesis of a plenitudinous hyperspace is true. Then, if it is nomologically possible for an object to leave our three-space, enter a neighboring region connecting two distant locations in our own three-space (albeit a region where light travels just as fast as it does locally), and reenter our own three-space at “the end of the tunnel,” then again it could travel from one point in our three-space to another point in our three-space faster than light could make the trip (provided that the light was not permitted to shortcut through the tunnel, as well). In another perfectly good sense, then, such travel would count as superluminal motion, and since it could also carry a causal signal, as superluminal causation.⁶

Third, not everything that comes from my original four principles is as innocent as Quick. Note a curious application of the principle of motion on which I earlier relied. Recall

(MO): Necessarily, (a material object, x , is in motion during an extended interval t , if (i) at every instant in t , x occupies a region of space; and (ii) at no two instants in t does x occupy the same region of space).

Suppose Xerxes is a time-traveler. Decompose Xerxes into three temporal parts which (in the order imposed by his personal time or by causal dependence or by whatever you want to call it) are arranged A,

⁶ Just in case it is not obvious, the main difference between the first and second scenarios is simply that on the first I made use of the additional assumption that there might be some subregions of hyperspace in which light moves faster than it does in our own three-space.

then B, then C. Here, though, is how A and B and C appear on the world's stage (in objective time or real time or whatever you want to call it). A begins at t_1 , and occupies all the times up to but not including t_2 . B begins at t_{10} and occupies all the times up to but not including t_{20} . C begins at t_2 and occupies all the times up to and including t_3 . Informally, as a young man, Xerxes time-travels into the distant future, lives most of his life there, and then returns to the time he first left to end out his days. Further facts: when A goes out of existence, a youthful Xerxes is walking about in the garden, and when C comes into existence, an elderly Xerxes is sitting in the library (where the closures of these two regions are at no point any closer than 30 feet from one another).

Now suppose that (MO) is true. In virtue of the facts about his temporal parts, A and C, Xerxes (discontinuously) moves from the garden to the library, and in doing so moves faster than light, and (owing to the gen-identity interrelatedness of his temporal parts) is a shining example of superluminal causality (i.e., events occurring in Xerxes at times before and arbitrarily close to t_2 are partial causes of events occurring some 30 feet away in Xerxes at t_2). If it helps, Xerxes could be a particle rather than a person.

Fourth, let me begin this next scenario with a preliminary point. Suppose (speaking loosely) I gain a new part, say an atom, at t . Then (speaking much more carefully) I will have two instantaneous temporal parts positioned arbitrarily temporally close to one another, the later of which has the t -slice of that atom as a part, and the earlier of which does not have any temporal part of that atom as a part. No one thinks that this prevents those two person-stages from standing in the requisite immanent causation relation—not even after realizing that *some* parts of the later stage do not depend causally for their features upon any parts of the earlier stage. The gen-identity relation among the temporal parts of persons simply does not demand such comprehensive causal dependence, for if it did, we would have a temporal series of rather short-lived persons where we thought we had but one. Keep that in mind.

Now meet a new protagonist: Torus is a donut-shaped material object whose outermost circumference is roughly two feet (less roughly, two-billionths of a light second). Review the construction of Quick in section 1, and then imagine another two-dimensional, disc-shaped character—Orbiter—who takes the trip around Torus in a billionth of a second (i.e., at twice the speed of light). Like Quick to Cone, Orbiter

is a proper part of Torus. So far, nothing new. But now consider the other proper part of Torus—the complement of Orbiter in Torus (hereby named ‘LittleTorus’)—whose salient features are as follows: at every moment Torus is present, LittleTorus is also present and shares every momentary part with Torus at that time, save for the two-dimensional disc that belongs to Orbiter at that moment. Just like Orbiter, LittleTorus is also a superluminal traveler. But LittleTorus is one dimension bigger than Orbiter and drags a tail behind him.

Now recall the preliminary point above: namely, that immanent causal relations between temporal parts do not demand such comprehensive causal dependence that I would not be able to gain new parts. It is instructive to note that arbitrarily close temporal parts of LittleTorus have a *much* better claim to complete causal dependence of the latter on the former than do many of my own person-stages. A single instant can never mark the loss or gain of more than a single, two-dimensional disc for LittleTorus, whereas a single moment can mark the loss or gain of a sizeable number of much larger parts for me. In fact, one might think that when it comes to chalking up the degree of causal dependence of later stages on earlier stages (in cases involving the loss and gain of parts), there isn’t anything we regularly quantify over that could boast a better score than LittleTorus.

I rather like all of the first four options for superluminal causation. Still, I can imagine worries about the rather relaxed talk of material objects exiting and reentering different regions of hyperspace (when those regions are allegedly distinguished by different values in what we termed their cosmic conditions), about the intelligibility of time-travel stories, and about what appears to be a cheating strategy for a verdict of superluminal causation exemplified by LittleTorus. (What’s the cheat? . . . Well, even though our principle about motion, (MO), unambiguously declares LittleTorus in motion, and even though we have so arranged the example as to ensure the appearance of directed superluminal motion (i.e., the appearance of, say, clockwise motion in its solitary spin around Torus), there is also another perfectly clear sense in which LittleTorus is staying more or less stock-still throughout the story, and to be honest, the immanent causal interrelatedness of its temporal parts hinges quite clearly on this feature of the example.) Are there, then, any prospects of superluminal causation which might avoid some of these potentially troublesome responses?

Fifth, there is a growing literature on the topic of temporal gappiness and on whether the familiar objects of our everyday lives such as human hands could survive a temporal gap in their being present. (An object is temporally gappy when there are three times (whether moments or intervals)— t_1 , t_2 , and t_3 —such that t_2 is between t_1 and t_3 , and the object in question is present at t_1 and t_3 but not present at t_2 .) Much of this exciting work has been occasioned by recent attempts to bring contemporary tools to the problem of squaring the Christian doctrine of the general resurrection of the body with a materialist theory of human persons, while other contributions to the discussion are rooted in a variety of objections to and defenses of traditional theories of identity across time. I do not wish to review that literature again here.⁷ But I would like to close this chapter by drawing the reader's attention to a few key elements in this debate.

One of the most challenging objections to a thesis of the possibility of temporal gappiness for objects like persons, chairs, and coffee cups is just that the causal continuity required for the persistence of these ordinary objects would seem to be forfeited. Recall a distinction: I reject the general claim that the persistence of every material object requires causal relations between its temporal parts, since (given my commitment to universalism) I countenance arbitrary cross-time fusions. But just to be clear, the conditions under which there is some material object or other are much less strict than the conditions under which there is, say, a persisting dog; whereas the fusion of the temporal part of my favorite dog up to and including the present moment with the temporal part of your favorite dog at times after but arbitrarily close to the present moment is a perfectly good material object and doglike at every moment it is present, it's no dog.⁸ Accordingly, if immanent causal connections could not span a temporal gap, then those opposed to the possibility of temporal gappiness for the objects falling under our everyday concepts would be on the correct side of the debate.

⁷ For an overview of much of the literature sparked by the attempts to reconcile a materialistic theory of human persons with the doctrine of the general resurrection and of the salient objections and replies to psychological theories of personal identity, see my 2001*a*: chs. 7 and 4 respectively.

⁸ Suppose that my favorite dog is in Washington and yours in New York. Then the hybrid doglike fusion just described is a superluminal traveler who does not furnish any instance of superluminal causation. Thus, he is more like Quick than Xerxes in the discussions above.

Nevertheless, I find compelling the possibility of immanent causal connections spanning a temporal gap, and thus I cannot lend my support to this objection.⁹ To be fair, however, the mere temporal gappiness of immanently causally interrelated objects would not guarantee superluminal causation (even if it would guarantee causal connections), for the simple reason that if the temporal gap and spatial locations are properly chosen, a subluminal causal signal *could have* reached the “reentry point” from the “departure point,” so to speak. Superluminal causation would be an issue only if the last pre-jump temporal parts of the allegedly temporally gappy object were separated by a distance from the first post-jump temporal parts of the allegedly temporally gappy object that could not have been traversed by light in the period of time defining the gap in question. As would be the case, for example, if an object’s last pre-jump temporal part is present in Rochester at noon while its first post-jump temporal part is present in St Louis at one billionth of a second past noon.

Even if such a halfway-across-the-continent journey by discontinuous jump and temporal gap were metaphysically possible, is there any reason to think that it is also nomologically possible? I think this is an excellent question. Perhaps any reasonable belief in an affirmative answer would require some insight into the physical processes (or ranges in which chance might be operative) that could bring it about (or in which it might occur). Alternatively, it might require some supernatural intervention like the backtracking decree of a divine being. I think both options are worth pursuing.¹⁰ Accordingly (in the case of objects falling under our everyday concepts), if there are good natural (or supernatural) reasons that speak in favor of discontinuous jumps with temporal gaps between regions that cannot be connected by light during the period of the gap, then there are good reasons to think that superluminal causation is nomologically as well as metaphysically possible.

⁹ See in particular the discussions in Zimmerman 1997 and 1999.

¹⁰ In fact, I think something like the second option will be actual as a requirement for the general resurrection, but since I wish to put my religious beliefs on hold until Chs. 7 and 8, I won’t make a fuss about it now. Once again, for those interested in this topic, see Zimmerman 1999 and my 2001*a*: ch. 7.

6

Mirror Determinism and Mirror Incompatibilism

§1 A Quick Note on Freedom and Moral Responsibility

A *very* quick note. Elsewhere, I have defended what seems right to me about (i) the status of those things which we do freely and of those things for which we are morally responsible, and (ii) the conditions under which we are free and under which we are morally responsible for what we have done.¹ I have nothing further to add to my previous discussion (nor to the ballooning literature on these topics) here, but I would like to be up front about these two issues in particular, in order to let the reader know exactly what I take to be defensible presuppositions on freedom and moral responsibility in the discussion to follow.²

With that said, I believe that those things which we do freely are action-particulars (a species of event-particular with precise spatio-temporal features and a distinctive causal history involving practical reason and volition), and I think that those things for which we are morally responsible are states-of-affairs-particulars (a special arrangement of contingent individuals in virtue of which some contingent state of

¹ In my book on Kant's compatibilism I discussed these two topics in particular as a preliminary task in my attempt to show that not only was Kant on the correct side of these debates about freedom and moral responsibility, but also that his view was consistent with (and to some extent anticipatory of) the very best current resolution of certain problems arising from deterministically inspired threats. See my 1994, which also contains an overview of a few choice centerpieces in this literature.

² A warning: this chapter is least like the others, and will undoubtedly strike some as bizarre, especially in its final two sections. I suppose that's probably a pretty fair assessment. It seems to me, though, that the opportunity afforded by the hypothesis of hyperspace to consider the metaphysics of reflections, some new kinds of determinism and incompatibilism, and a novel and curious role for counterpart theory make a little bizarreness worth wading through.

affairs obtains). Accordingly, those things for which we are morally responsible can include those things that we freely do as well as some of the consequences of those things that we freely do.

Furthermore, I think that both freedom and moral responsibility require the infamous ability to do otherwise. In other words, I fully endorse two controversial views that we may formulate as follows:

(FO): If S freely performed action-particular, A, then S could have done otherwise than A.

(MRO): If S is morally responsible for state-of-affairs-particular, O, then there is something S could have done, such that if S had done that thing, then O would not have existed.

Of course, some other arrangement of contingent items might then have been that in virtue of which the relevant (abstract) state of affairs obtained, but then that would be a different state-of-affairs-particular for which S may or may not have also been morally responsible. The main upshot of these two principles in the sequel will be simply to block a rather popular response to the worry that a given kind of determinism might eliminate freedom in the agents who fall under its scope.

§2 Logical, Causal, and Theological Determinism

The global determinist and his indeterminist opponent agree about something: namely, that there is exactly one way in which the future will unfold. And they disagree about another: namely, the global determinist's further assertion that there are conditions in place right now which determine which way that is. (More generally, perhaps, the determinist further asserts that at any moment of time, t , there are conditions in place at t which determine the future with respect to t .)

Determinists come in different flavors, and may be sorted by their different answers to this question, "So just which conditions in place right now determine the future?". Historically, there have been three main kinds of answer to this question.

Causal determinists (a type of global determinist) answer that the complete state of the world at the current time together with the laws of nature determine the future. Theological determinists (another type of global determinist) answer that the current comprehensive foreknow-

ledge (or perhaps forebelief) of an omniscient being determines the future. Logical determinists (a third type of global determinist) answer that present truths about every aspect and detail of what is to come determine the future. (Note to the reader: my terminology is perhaps a bit idiosyncratic. It is common to refer to what I single out with the phrase 'logical determinism' by the term 'fatalism', but I think there are good reasons not to do this. 'Fatalism', like 'determinism', has the connotation that the future is fixed, but, unlike 'determinism', has the further connotation that there is nothing that any of us can do about it—that everything that happens is unavoidable for us. As will become clear in section 3 below, this is a hotly contested additional claim, and I see no reason to exclude a particular compatibilist/incompatibilist debate by way of tendentious definition.) Finally, these three versions of determinism are entirely independent of one another; it is consistent to hold any of the eight combinations generated by accepting or rejecting the three determinisms in question.³

Being consistent is one thing, but defending one or more of these deterministic theses is another thing altogether. Causal determinists have the unenviable task of properly specifying what it is for there to be a complete state of the world at a time and how to reconcile this description with various pronouncements of indeterminacy and ontological vagueness from various corners of contemporary physics and metaphysics. Moreover, these theorists represent an ever diminishing voice in the tremendously difficult battles over the proper characterization of causation and the laws of nature. It is not clear, however, that the theological determinists are much better off (even among their theistic fellows), since deep, entrenched disagreements about the correct list of divine attributes, the proper analysis of 'omniscient', and the bitter debates concerning how God relates to time all throw up considerable obstacles in the path from theism to theological determinism. And even the least presumptuous of the lot—the logical determinists—have their share of difficulties, since puzzles in the philosophy of time, the metaphysics of propositions, the need for truthmakers, and the conditions under which truth-values are manifested all threaten to upend that thesis, as well.

³ I suppose that a reasonable case can be made for the claim that theological determinism implies logical determinism; but this depends (I think) on how one unpacks 'omniscience' and 'eternality'. In any event, I will treat them as logically independent.

Fortunately, perhaps, most of the philosophical ink that has been spilled over these determinisms is not ultimately aimed at establishing their truth or falsity, but instead at establishing what can and cannot be joined to them without forfeiting consistency.

§3 Naive, Frankfurt, Conditional Analysis, Soft-Fact, Altered-Law, and Altered-Past Compatibilism

The natural and long-standing worry, of course, is simply that these determinisms threaten something we hold very dear—the nearly universal supposition that we occasionally choose between genuinely alternative courses of action and (that at least some of us at least some of the time) thereby act freely and are morally responsible for what we have done. And this *is* something we hold very dear. Many of our beliefs would be false, many of our reactive attitudes would be inappropriate, and many of our social institutions would stand on insufficient foundations if it were the case that we were neither sometimes free nor sometimes morally responsible.⁴

Incompatibilists (with respect to some given kind of determinism) see this threat as real, maintaining that if the determinism in question is in force, then we are neither free nor morally responsible—usually (but not universally) on the grounds that the determinism in question is sufficient to rob us of the ability to do otherwise, and that this ability is a necessary condition on freedom and moral responsibility. Compatibilists (with respect to some given kind of determinism) see this threat as merely apparent, maintaining that if the determinism in question is in force, then our freedom and moral responsibility are not *thereby* in jeopardy—usually (but not universally) on the grounds that the determinism in question is silent on whether or not we enjoy the crucial ability to do otherwise. As I have done above, I qualify an attribution of incompatibilism or compatibilism with the phrase ‘with respect to some given kind of determinism’, since just as one can hold any combination of the determinisms consistently, so too, going compatibilist or incompatibilist on some given pairing of a particular determinism with

⁴ Of course, we wouldn’t be blameworthy for these false beliefs or inappropriate attitudes, inasmuch as we would not be responsible for them either, but setting questions of blameworthiness aside—things would be bad enough!

freedom and moral responsibility does not always force one's hand on the relevant debates for the other available pairings.

Strategies for going compatibilist are numerous. One rather historically popular (but unappealing) tactic is to pretend that there is no philosophically interesting or sophisticated threat to confront (perhaps after pretending not to understand what the threat is really supposed to amount to and then abusing one's audience until they are also sufficiently motivated to pretend not to see it). Let us call this 'naive-compatibilism'.⁵ One currently popular tactic is to deny that freedom and moral responsibility require the ability to do otherwise, after all, and then to promote indifference about whether or not some given determinism inhibits or eliminates that capacity. This latter approach we may call 'Frankfurt-compatibilism' (after Frankfurt 1969), and it has been at the center of an intense pocket of literature in the writings on free will and moral responsibility over the last 30-some years. However (given the restrictions announced in section 1 above), I am willing to regard it as a nonstarter. Others disagree. Let it be known, then, that those others will have nothing new to fear from the considerations I will put forth below.

Much more intriguing, say I, are four other strategies for going compatibilist, strategies which turn on (i) the conditional analysis of the ability to do otherwise, (ii) the hard-fact/soft-fact distinction, (iii) an alleged non-causal control over the laws of nature, and (iv) an alleged non-causal control over (hard facts about) the past. In the interests of preparing for the new kind of determinism to be explored below, permit me a brief overview.

The conditional analysis strategy attempts to undercut the claim that the truth of determinism would exclude the ability to do otherwise on the grounds that the phrase 'S is able to do otherwise than A' is an '-ible' claim, and that it should therefore be analyzed like other '-ible' claims. That is to say, just as 'x is visible' (allegedly) means that if x were in such and such conditions, then x would be seen, and 'x is water-soluble' (allegedly) means that if x were placed in water, then x would dissolve, so too,

⁵ Fortunately, I think naive compatibilism is less prominent than it once was, its drop in popularity occasioned by very talented analytic thinkers putting some concentrated effort into the task of clearly articulating the threat. See, for instance, van Inwagen 1983.

'S is able to do otherwise than A' (allegedly) means that if S were to choose to do otherwise than A, then S would do otherwise than A.⁶

The upshot, then, is that the truth of determinism is compatible with the truth of the relevant counterfactual, and thus poses no threat to freedom by way of eliminating the relevant ability to do otherwise (which, by hypothesis, is synonymous with the relevant counterfactual). Of course, this strategy is only as strong as its central synonymy thesis, and there are good reasons to suspect that thesis in a range of very plausible cases; in particular, the conditional analysis often appears to generate the wrong result, since along with the least disruptive change required to evaluate the relevant counterfactual, there will be crucial changes in what the agent is able to do. But I am currently more interested in recording this popular strategy than in critiquing it, so let us move on.⁷

The hard-fact/soft-fact distinction is frequently invoked to show that there is a perfectly straightforward sense in which we have control over some facts about the past. As a bit of background, consider action at a spatial distance. I can act in such a way as to bring about a change in the properties of my dog without ever going anywhere near my dog. I can, for instance, change his color by throwing a can of paint on him from the rooftop above. But that's not really the kind of action at a spatial distance that I'm after, since there is a casual intermediary traversing the spatial distance between us. More interestingly, I can make my dog come to have the property 'being the same color as this piece of chalk' by staying right here and painting this piece of chalk. Note, however, that I enjoy this kind of control over my dog (i.e., the kind without causal intermediaries) only over properties that aren't simply about my dog. Similarly, then, one might introduce a distinction between facts that are simply about the past relative to a time t and facts that are not simply about the past relative to a time t . In accordance with tradition, let us use the locutions 'P is a hard fact about the past at t ' and 'P is a soft fact about the past at t ' to mark this distinction.

An illustration can prove helpful. Suppose my alarm went off at 6:00 a.m. this morning, and suppose that I (in fact) got out of bed

⁶ Instead of 'choosing', one might try 'willing', 'deciding', 'endeavoring'; or, as in D. Davidson 1980, one might look for a state such as 'having sufficient reason' rather than an action.

⁷ For an excellent introduction to this strategy, see Fischer 1986.

at 7:00 a.m. this morning. Currently (i.e., at the time of this writing), we have two hard facts about the past: 'B', which names the fact that the beeping of my alarm preceded my rising by one hour, and 'R', which names the fact that I rose at 7:00 a.m. (Indexed to our current time, these two facts are both simply about the past.) Moreover, at 5:00 a.m. this morning, neither B nor R was a hard or soft fact about the past, since at that time neither event had occurred at all. But what about 6:30 a.m. this morning?

Well, at 6:30, R wasn't about the past at all, and in fact, we might well think that I had it within my power at 6:30 a.m. to prevent R from occurring. In other words, I could have risen at 6:35 a.m. (even though I didn't actually do so). But if I had done so, then R would not have been a fact (even though it actually is a fact). Accordingly, at 6:30 a.m., whether R was ever a fact was up to me. Interestingly, though, at 6:30 a.m., B wasn't simply about the past. Even though B was about the past then, B was a soft fact about the past at 6:30 a.m. Consider, then, once again the fact that I could have risen at 6:35 a.m. (even though I didn't actually do so). If I had done so, then even though B was about the past then, B would not have been a fact, at all. (Just to be clear—the beeping would have occurred all the same, but that event would have lacked the relational property to my rising that is reported in B). Accordingly, at 6:30 a.m., whether B was ever a fact was up to me. This, then, is our proper temporal analogue of action at a spatial distance. The moral of this story is that sometimes we do have power over the past—in particular, we sometimes have power over certain past facts at times relative to which they are soft facts about the past.⁸

This distinction, I believe, is fatal to incompatibilism between logical determinism and free will (or moral responsibility), less clearly fatal to incompatibilism involving theological determinism, and more or less worthless when applied to incompatibilism involving causal determinism. My reasons for these verdicts are simply that logical determinism seems exclusively concerned with soft facts about the past, causal determinism seems exclusively concerned with hard facts about the past, and theological determinism seems concerned with both types of facts about the past (e.g., God's states of forebelief are plausibly regarded as hard

⁸ Once again, for an excellent introduction to this strategy, see Fischer 1986. (The helpful illustration above is adapted from his very accessible presentation.)

facts about the past). But once again, I am more interested in adding this popular strategy to our stock of ammunition than in critiquing it, and again let us move on.

The final two strategies for compatibilism are similar enough to be presented together and are known by the names ‘altered-law compatibilism’ and ‘altered-past compatibilism’.⁹ Frequently, a given incompatibilist argument seems unassailable, since it appears that in order to contest its premises, the compatibilist would have to maintain that we can sometimes act in such a way that either the hard facts about the past would not be what they were or else the laws of nature would not be what they are. But, as David Lewis has wittily remarked, “if we distinguish a strong and weak version of this incredible consequence, I think we shall find that it is the strong version that is incredible and the weak version that is the consequence”.¹⁰

The point is that we can insist on a distinction between a strong and a weak sense of having control over the past or the laws, and thereby hope to show that whereas attributing to ourselves the strong sense of control is just as outlandish as the incompatibilist would have us believe, it is only the weaker (and more reasonably attributed) sense of control that is required for the compatibilist position to emerge victorious.

Accordingly, the altered-past compatibilist maintains that (on some occasions), there is something that she is able to do at a time such that if she were to perform that action at that time, then the past (relative to that time) would have been different than it in fact is. But—she is quick to add—this is not to say that she has a causal control over the past; rather, it is just that a certain backtracking counterfactual is true—if she were to do something that she is able to do (and doesn’t in fact do), then the past would be different (than it in fact is). Similarly, the altered-law compatibilist maintains that (on some occasions) there is something that he is able to do at a time such that if he were to perform that action at that time, then some “local miracle” would have occurred shortly before that time. (Initially this talk of miracles may sound bizarre, but

⁹ As with the other four forms of compatibilism just canvassed, my goal in discussing these two forms is simply to provide a rough-and-ready overview of the strategy with just enough detail to reveal whether the strategy can be adapted to the new kind of determinism I will introduce in section 5 below. For much more detailed discussions of these remaining two strategies see (especially) Flint 1987, Fischer 1986 and 1989, and my 1994: ch. 3.

¹⁰ See Lewis 1981: 223, which contains a defense of altered-law compatibilism.

the apparent absurdity quickly vanishes when the notion of such a local miracle is properly clarified. Lewis (1981), the chief advocate of altered-law compatibilism, clearly does not think that miracles or law-breaking events actually occur, and thus when he suggests that a law is broken, he means simply that some generalization is broken in another possible world and is not a law in that world, although it is a law in the actual world.) But, as before, this is not to say that he has causal control over the laws; rather, it is just that a certain backtracking counterfactual is true—if he were to do something that he is able to do (and doesn't in fact do), then the laws of nature would be different (than they in fact are).

Whether one responds as an altered-law compatibilist or as an altered-past compatibilist may well depend on one's view of what it takes for one possible world to be more like the actual world than another. Should one think that possible worlds with different pasts but the same laws are closer to the actual world than are possible worlds with different laws but the same pasts, then one is likely to respond as an altered-past compatibilist; if not, then one is likely to respond as an altered-law compatibilist.¹¹

The significant question then becomes whether we should hold fixed the past and the laws when we are attempting to identify those actions that are among an agent's genuine alternatives at a time (i.e., among the alternatives relevant to ascriptions of freedom and of moral responsibility). In other words, the incompatibilist might fully accept our distinction, and then retort that we were quite right in thinking that she would object to the strong sense of having control over the past or the laws, but dead wrong in thinking that she wouldn't also object to the weak sense, as well; rather, she might continue, the only genuine alternatives that we have at a time are those which are consistent with the actual laws and the hard facts about the past at that time. The controversy continues to rage over this question, but my goal of outlining these remaining compatibilist strategies has been satisfied, and once again I am ready to press on.

¹¹ Alternatively, if one desires the same medicine for what looks like the same ailment, one might opt for altered-past compatibilism, for this strategy has bite against the threats from both causal and theological determinism, whereas altered-law compatibilism is toothless against the threat from theological determinism. The reason is that whereas in the case of causal determinism the determining laws of nature are metaphysically contingent, in the case of theological determinism the analogous principle about God's foreknowledge is metaphysically necessary.

§4 Many-Brothers Determinism and Many-Brothers Compatibilism

The local determinist (like the global determinist) agrees that there are current conditions that are future-determining; but, unlike his less modest associate, he holds that these conditions merely determine some, rather than all, aspects of the future. Of course, local determinism becomes interesting practically (and not just philosophically) when some of the aspects in question concern the actions of agents who take themselves to be free.

Recently, I introduced and examined a new local determinism—many-brothers determinism—in the course of critically evaluating David Lewis’s ‘many-persons solution’ to what is known as the Problem of the Many. Very briefly, that marvelous and under-appreciated problem can be summarized as follows. Let ‘T’ name one of the innumerable many moments that have elapsed since you began reading this chapter just a while ago. Now you exist at T. But at each moment of your existence there exists a set which has as its members all and only those material simples that compose you at that moment. Consequently, there is such a set at T that we hereby name ‘the Primary Set’. Furthermore, you are a person at T. But your being a person at T supervenes on facts regarding the environment, histories, types, arrangements, and intrinsic properties of those material simples that compose you at T, the very members of the Primary Set. Let us use the phrase ‘satisfying the person-composing conditions’ to denote the exemplification of whatever environmental, historical, kind, and relational properties turn out to be jointly sufficient for some collection of material simples to compose a person at a time. Then we may draw the following conclusion: the members of the Primary Set have what it takes at T; since you are a person at T, and since the Primary Set contains all and only the material simples that compose you at T, those material simples clearly manage to satisfy the person-composing conditions at T.

Now the problem starts to arise. The Primary Set is gigantic, with some $10^{28}+$ members; that’s over a billion members for each second that has elapsed since the big bang (on a generous estimate of some 20 billion years). It’s a big set. Still, the fusion of its members doesn’t really take up all that much room. In fact, there are lots of things left over, some of them quite close to the members of the Primary Set at T.

Consider some simple in the neighborhood of your left hand at T which is not a member of the Primary Set (here named 'Lefty'), and also consider some outermost simple on your right hand at T which is a member of the Primary Set (here named 'Righty'). We are now in a position to characterize a new set of material simples (here named 'the Secondary Set') as follows: the Secondary Set contains all the material simples found in the Primary Set except Righty, and it contains no other items except Lefty. So, each of our two sets has exactly one member the other lacks, and accordingly neither of our two sets is a subset of the other. If we agree to call the fusion of the members of the Primary Set at T 'ThingOne', and the fusion of the members of the Secondary Set at T 'ThingTwo', then we may also note that neither ThingOne nor ThingTwo is a part of the other. Of course, the intersection of the two sets is huge, and the physical overlap (and overall resemblance) between ThingOne and ThingTwo is considerable, two features of our case that will prove very significant in a moment.

What do we know about the Secondary Set? Well, we know that it, too, is a set of some $10^{28}+$ material simples that (given the truth of universalism) together compose an object at T. We also know that the environment, histories, types, and arrangements of the members of the Secondary Set at T are exceedingly similar to those of the Primary Set at T, which (we should remember) is a set whose members satisfy the person-composing conditions at T, and which thereby is a set whose members compose a person at T. But the supervenience of personhood on the person-composing conditions is insensitive to differences as overwhelmingly insignificant as those between the members of the Primary Set at T and the members of the Secondary Set at T. Consequently, we have every reason to believe that if the fusion at T of the members of one of these sets is a person at T, then the fusion at T of the members of the other set is a person at T, as well. But that's significant—since we have agreed that ThingOne is a person at T, we are then committed to the claim that ThingTwo is a person at T, as well.

Now things start to get crowded. ThingOne (a human person) is sitting in your chair at T. But ThingTwo (a human person) is sitting in your chair at T. So, just how many persons are in your chair at T? We might still hope that there is just one, and that we here have two names for the same object. But that won't do. ThingOne is not identical to ThingTwo, for ThingOne has Righty as a part at T, and ThingTwo does

not have Righty as a part at T, and no object both does and does not have something as a part at the same time. So, it would seem that we have *at least* two persons in your chair at T. But it is rather obvious that there is exactly one person in your chair at T. Contradiction!¹²

David Lewis (1999) responds to this puzzle by denying the allegedly obvious—by maintaining that there really are many (uncountably many, it turns out) numerically distinct persons in your chair at T. He is quick to add, however, that there are at least two ways to recover the desirable answer that only one person occupies your chair at T, and he tries to soften the ontological blow by motivating and defending those two strategies.

After objecting at length to Lewis's defense, I proposed a very different criticism of his many-persons solution which requires entertaining a new kind of determinism. This local determinism is fueled by the claim that each of the overrapper's actions seems thoroughly fixed by the actions of each of the others, and that genuine freedom of action is incompatible with the kind of overlap and mutual determination at issue. If, for example, I am genuinely free to commit a murder, then it should be up to me and not to one of my overlapping-brothers (so to speak) whether I do so; but on Lewis's view, a free refusal on my brother's part *ensures* a refusal on my part as well. Consequently, to the extent that we believe ourselves to be free, we should resist a many-persons scenario.

In the end, the success of the argument from what I call 'many-brothers determinism' to a denial of freedom rests squarely on the defensibility of this problematic premise:

(PP): If (i) *A*'s freely doing *x* at *t* entails *B*'s doing *y* at *t*, and (ii) *B*'s doing *y* at *t* entails *A*'s doing *x* at *t*, and (iii) *A* freely does *x* at *t*, and (iv) *A* is distinct from *B*, then (v) *B* does not freely do *y* at *t*.

If (PP) is true (and it looks extremely plausible to me), then many-brothers determinism is lethal to freedom (and subsequently to moral responsibility). I've said what I can in favor of that premise elsewhere. Here I simply wish to note that if one should find some means of

¹² This characterization is adapted from my 2001*a* (and is presented in a manner friendly to those who take parthood to be temporally indexed, although this is an eliminable feature of the presentation). For a critical discussion of ten different solutions to this puzzle and for an introduction and defense of an eleventh, see my 2001*a*: chs. 1 and 2 respectively.

denying it, then one may accept a new kind of reconciliation thesis that can be called ‘many-brothers compatibilism’. It is significant, however, that a compatibilist strategy invoked in a denial of (PP) need not be assimilated to those strategies we have characterized as naive, Frankfurt, conditional analysis, soft-fact, altered-law, or altered-past compatibilism in the preceding section. The lesson at hand, then, is that there might be yet another route to recognizing that one’s actions are thoroughly determined by the free actions of a numerically distinct being, and yet nevertheless championing an ascription of freedom (construed so as to require the ability to do otherwise) to those very actions. Let us add this lesson to our list of possible compatibilist responses from section 3 and (thus equipped) turn to a new form of determinism and the peculiar threat it poses to our freedom and moral responsibility.

§5 Mirror Determinism

Mirrors are perplexing things. So are mirror images and the surfaces of the objects that cast them. I believe in reflections, and I take them to have a serious ontological status (i.e., I think our apparent commitment to their existence is resistant to being paraphrased away). But just what are they? One tempting answer is that they are projections formed by reflected light rays, and that the proper location of a projection is somewhere behind the surface of the mirror in operation. One worry about this proposal is that it would make the co-location of material objects a rather common affair, a point I will elaborate on below. Another (rather exotic) worry about it is that there could be a mirror hosting reflections in a bizarrely shaped substantialist space with no locations “behind” it at all. A different, tempting answer is that images are two-dimensional items that are co-located with the surface of a mirror. But this answer is both too casual and metaphysically problematic. It is too casual, for the surface of a mirror is almost always larger than and longer-lived than the image it contains. It is metaphysically problematic, for if reflections occupy space, then (according to the occupancy account of material objects endorsed in the Introduction) they are material objects, and to hold that they are co-located with mirror surfaces would then commit us to a problematic co-location of distinct material substances (a view whose denial I took as a starting point in the Introduction).

One of these difficulties—the complaint of casualness—can be resolved by specifying that we are concerned only with a proper spatial part of a proper temporal part of a surface of a mirror, an item which may be exactly the same spatial and temporal size as the image it contains. Fortunately, our adherence to the doctrine of arbitrary undetached parts and to four-dimensionalism offers us the resources to so specify.

The other difficulty—the problematic metaphysics—can be resolved with a bit of reduction. I propose that rather than endorsing a collocation of surfaces and images, we instead identify a proper spatial part of a proper temporal part of the surface of a mirror with the image it contains. Thus, we have one object, not two, and there is (of course) no problem in a thing's being co-located with itself.

In deviant scenarios, I suppose that a persisting image might be identified with the fusion of two or more proper spatial parts of proper temporal parts of mirror surfaces: when, for example, some demon sees to it that a mirror that exists up to but not including time *T* is seamlessly replaced with a qualitative duplicate at *T* and thereafter—but surely such scenarios are rare!

If I am correct in believing that reflections are to be counted among the genuine material objects in the world, then there are undoubtedly precise individuation and persistence conditions that they satisfy, and I suspect that properly filling in the following blank would be a delicate affair:

(MI): Necessarily, *x* is the same mirror image as *y* if and only if——.

We could make a brave start, though. As I have just noted, even if we adopt the reductive account of reflections, there need not be a single persisting mirror in order to have a single persisting mirror image. Presumably, this peculiarity follows from the way in which mirror images are dependent upon those objects that cast them. Mirrors, just like most of the common objects that fall under our everyday concepts, manifest immanent causal interrelatedness between their temporal parts, ensuring that the later temporal stages of a persisting mirror depend causally upon the earlier temporal stages of that same mirror. A mirror image, on the other hand, does not require causal interconnections between its temporal parts, but rather enjoys a unity imposed on its temporal parts in the form of the relation 'being dependent upon

on the same caster as' (where 'caster' is just the general term for an object reflected by the image in question). This relation is not a sufficient condition, since, as you stand in front of the tripartite mirror at your favorite clothing shop, you will see three numerically distinct images, each of whose temporal parts depend upon the same caster as those of the others. But it is a necessary condition, nonetheless. Perhaps another necessary condition is a kind of spatio-temporal continuity between the temporal parts of one and the same image, but temporally gappy or (more commonly) spatially gappy casters (whether perceptibly gappy or not) spell trouble for any simple-minded formulation of a connectedness restriction. I did, however, warn that filling in the blank would be a delicate affair.

Problem: how can it be that a single material object is both a proper spatial part of a proper temporal part of a mirror and also a mirror image, when the identity and persistence conditions for the former are distinct from those of the latter? Nothing is both such that it requires and also does not require immanent causal interrelatedness among its temporal parts. I think the best response to this problem is to borrow from what I take to be the best solution to the debates on the paradoxes of coincidence. As I noted in the Introduction, I favor a counterpart-theoretic account of *de re* modal predication. Accordingly, I take *de re* modal claims of the form 'x could have been F' to be made true by an object which is F and which bears the relevant counterpart relation to x, where relevance is contextually determined.¹³ Suppose, then, that we name the relevant proper part of the mirror 'Shiny' and that we name the image 'Reflection'. One way of putting the matter is to regard these two names as merely quasi-rigid designators (i.e., as rigid only under a particular counterpart relation), and thus as evoking different counterpart relations. Hence, although they in fact co-refer in non-modal contexts, 'Shiny' refers to mirror counterparts of our object in modal contexts, whereas 'Reflection' refers to its image counterparts in modal contexts. Accordingly, the modal judgments—that Shiny could not have survived a certain break in immanent causal connections and that Reflection could have survived—come out in just the right ways.¹⁴

¹³ Again, see Lewis 1986 and also Hazen 1979, and Plantinga 1974.

¹⁴ See Sider 2001, Rea 1997, and my 2001a: ch. 2 (from which I borrowed in this paragraph) for a more comprehensive discussion of this response.

Rather than further refining the analysis of ‘the same mirror image as’, I would like instead to make some suggestive observations about the inhabitants of Flatland and then turn to more serious matters in our own three-space. Flatland is a two-dimensional but very complex world. In his absolutely delightful story of Victorian manners, mathematics, and metaphysics, Edwin Abbott (1884) introduces us to a variety of inhabitants of a two-space world including triangles, squares, hexagons, and the like, and to an imaginative hero who (with a little assistance) struggles to comprehend a third spatial dimension and the wondrous beings that might inhabit that unpicturable realm. Let us pretend with Abbott that these two-dimensional beings whose voluntary movements are confined to the plane on which they live are conscious, free, and in society with one another.

Flatlanders have mirrors, too. They aren’t the proper mirrors with which you and I are familiar, but (continuing to set aside problems with light as is customary in these one-dimension-down warm-up exercises), they are line-segment-shaped objects that reflect a one-dimensional side of any Flatlander who positions himself in front of them. (Whereas we enjoy two-dimensional visual presentations and then invoke various cues for awareness of depth, Flatlanders see only one-dimensional images and depend upon shading and contrast to determine whether they are addressing the straight side of a square, the end-slanting sides of an octagon, or the gentle curve of a circle.) Now, Flatlanders (like us) might be inclined to identify their reflections with spatial parts of temporal parts of their mirrors and (like us) might be inclined to regard images as a kind of second-class citizen in the world of material objects—one who borrows all of its interesting properties from the surface of its two-dimensional caster.

But if, like our hero in the story, their philosophers should come to believe that they inhabit a two-space cross-section embedded in a three-space from which they are unable to escape by their own power (a two-space prison, so to speak), then they could come to worry about the following alarming possibility. Perhaps one or more of them is a mere reflection of the surface of some three-spacer who uses their two-space prison as a mirror (or perhaps even a reflection of another two-spacer similarly confined to his own parallel two-space prison just inches away). And what dignity has a mere reflection? It would seem that

such thoroughly dependent things are hardly free and in meaningful society with one another.

Worrisome for the Flatlanders, perhaps, but surely not so for us, for the Flatlanders are make-believe, and no one takes their story to report events in the lives of real persons. But, as with other ideas best introduced by way of the Flatlanders, so too, for what I would like to call 'mirror determinism'. Just as a two-space can house a mirror embedded in three-space, so too, a three-space can house a mirror embedded in four-space. Just as a two-space mirror is suited to reflect the surface of a three-spacer or else of some distant and properly positioned two-spacer, so too a three-space mirror is suited to reflect the surface of a four-spacer or else of some distant and properly positioned three-spacer. And what dignity has a mere reflection, even if it is three-dimensional? It would seem that such thoroughly dependent things (whether sporting depth in addition to height and width or not) are hardly free and in meaningful society with one another. (*Just a quick note before proceeding*: Earlier I observed the customary sidestepping of the problems of physics and of light in Flatland, despite the fact that the intelligibility of talk of Flatland mirrors seems to hang in the balance, and I would cheerfully like to inaugurate the tradition of similarly sidestepping problems of physics and of light in four-space, on which the intelligibility of talk of three-space mirrors would seem equally precarious. This simply because I am rather less interested in defending in any detail the thesis that some particular three-dimensional object is to be identified with some kind of image and in speculating on the physics of reflection in hyperspace than I am in painting a scenario in which the view that there exist such parasitic entities has some foothold and in exploring the compatibilism/incompatibilism debate thereby generated. For the record, though, not everyone opts to sidestep.¹⁵)

Let us recognize 'mirror determinism' as a version of local determinism, and let us say that an object is mirror-determined if both (i) it is a reflection of some other object and (ii) its behavior is thoroughly fixed by the activities of its caster together with the relation between its caster and the mirror of which it is a proper part. Let us recognize 'mirror

¹⁵ For example, entertaining reflections on Flatland and hyperspace physics can be found in Dewdney 1984 and Rucker 1984.

incompatibilism' as the thesis that being mirror-determined and being free (or morally responsible) are incompatible with one another.

Why would anyone be a proponent of mirror determinism (with respect to some given object)? First, distinguish this from the question, "why would anyone take a three-dimensional object to be a reflection of anything?", and then note that the original question before us simply directs our attention to those reflections we already countenance and then makes a claim about the external sources of their behavior. Once this is clear, however, it would be hard to see why anyone who believes in reflections at all wouldn't be a proponent of mirror determinism. It seems as clear as can be that if there are such things as reflections—items whose temporal parts need not be immanently causally interrelated and who depend for their most salient qualitative features and for their identity and persistence conditions upon their casters—then the behavior of those items is ultimately fixed by the activities of the casters upon which they are parasitic.

Why would anyone be a proponent of mirror incompatibilism? Two reasons—one a killjoy, and the other in the spirit of things.

The killjoy reason: necessarily, being mirror-determined (if a feature of anything at all) is a feature of two-dimensional objects, and, necessarily, two-dimensional objects don't have the structure or internal complexity to support consciousness or freedom, and hence, necessarily, if something is mirror-determined, then it is not free. Well, I don't care for either premise, but fair enough; perhaps the note below, however, may work towards rekindling the interest of the proponent of the killjoy reason.¹⁶

¹⁶ So maybe it doesn't all have to be done with mirrors. Perhaps you'll find more intriguing the notion of 'surface determinism'. Just as a two-spacer is suited to be the surface of a three-spacer, so too, a three-spacer is suited to be the surface of a four-spacer. And what dignity has a mere surface, even if it is three-dimensional? As a first pass, let us recognize 'surface determinism' as a version of local determinism, and let us say that an object is surface-determined if it is a surface of another object. Further, let us recognize 'surface incompatibilism' as the thesis that being surface-determined and being free (or morally responsible) are incompatible with one another. Note, however, that it is not likewise automatic that the behavior of a surface-determined object (thus described) is thoroughly fixed by the activities of its host. On the contrary, one can imagine an inert cube that is pulled along by the willful activity of its uppermost face. To enrich surface-determinism so that it stands some chance of generating a plausible threat in the end, let us say that an object is surface-determined if (i) it is a surface of another object, and (ii) the free actions of that further object fix the behavior of all of its surfaces. With this backup on offer, then, perhaps there will still be something of interest in the remainder of this chapter for the proponent of the killjoy reason.

The in-the-spirit-of-things reason: necessarily, mirror-determined items are powerless with respect to (i) the activities of their casters, (ii) the relation between their casters and the mirrors of which they are proper parts, and (iii) the fact that the activities of their casters together with the relation between their casters and the mirrors fix the behavior of the mirror-determined item in question. But then we may anticipate a transfer of powerlessness, for it would certainly appear to follow that, necessarily, mirror-determined items are powerless with respect to their own behavior. And, if powerless in that respect (i.e., if unable to do otherwise), then not free.

§6 Mirror Incompatibilism

What are the prospects for mirror compatibilism? Let us grant the existence of a three-dimensional object that certainly appears to be a person with free will, but let us assume for the sake of the argument that this creature is a reflection of some numerically distinct three-dimensional item (whether or not this further thing is the surface of some four-dimensional object), and let us assume (as we should with any reflection) that our protagonist is mirror-determined.

As I indicated above, my starting points rule out naive and Frankfurt compatibilism (although it is perhaps worth noting that even those who are more attracted to Frankfurt compatibilism than I am will have a difficult time showing that the apparent person genuinely manifests thoughts and intentions—for reasons that will be revealed below). Renewed appeals to the conditional analysis of freedom are (once again) only as strong as the central synonymy claim endorsed by that analysis, and (once again) we have good reason to be suspicious of that thesis about meaning. Moreover, insofar as the proponent of the conditional analysis depends on a free agent's being the kind of thing that could choose, intend, deliberate, or have sufficient reasons, this theorist (like the friend of Frankfurt compatibilism) will have a difficult time showing that the apparent manifestation of these features is genuine. And finally, whether or not the hard-fact/soft-fact distinction is lethal to the incompatibilisms involving logical determinism and theological determinism, it simply seems to have no application to mirror determinism; for whereas the conditions that determine the features of our

hypothesized reflection are partly facts about the past—e.g., the reflection of my dog has its salient features determined partly by the way my dog was a split second earlier—those are clearly hard facts about the past involving the shape, contour, and color of my dog's coat and countenance at the earlier times. Accordingly, our first four strategies for compatibilism offer the would-be mirror compatibilist little assistance.

Altered-law and altered-past compatibilism may seem to fare a bit better. In the case of mirror determinism, the behavior of the reflection is thoroughly fixed by the activities of its caster together with the relation between its caster and the mirror of which it is a proper part. Thus, the rules that specify the relevant relation are the analogue of the laws of nature which are partly responsible for determining the future in causal determinism scenarios. Similarly, then, those reflection rules, as we may call them, would be the focus of an altered-law compatibilist's strategy. The thesis on offer would then be that (on some occasions) there is something that our hypothetical three-dimensional reflection is able to do at a time such that if he were to perform that action at that time, then some "local miracle" would have occurred shortly before that time. And, as before, this talk of miracles simply boils down to the claim that some generalization is broken in another possible world and is not a reflection rule in that world, although it is a reflection rule in the actual world. Moreover, as before, this is not to say that the reflection has causal control over the reflection rules; rather, it is just that a certain backtracking counterfactual is true—"If the reflection were to do something that he is able to do (and doesn't in fact do), then the reflection rules would be different (than they in fact are)." Likewise, the altered-past compatibilist would put forth the thesis that (on some occasions) there is something that our hypothetical three-dimensional reflection is able to do at a time such that if he were to perform that action at that time, then the past (relative to that time) would have been different than it in fact is. But, he is quick to add, this is not to say that the reflection has a causal control over the past; rather, it is just that a certain backtracking counterfactual is true—"If the reflection were to do something that he is able to do (and doesn't in fact do), then the past would be different (than it in fact is)."

There would seem, then, to be some hope for adaptation of these two strategies to a defense of mirror compatibilism, or (to put it more pessimistically) they would at least seem to do no worse than when

put to the task of defending compatibilism involving causal determinism and free will. Opponents of these strategies in their traditional setting will, of course, know the lines of response and will undoubtedly back the familiar refrain that we should hold fixed the past and the reflection rules (which are either a subset of or derivable from the laws of nature) when attempting to identify those actions that are among an agent's genuine alternatives at a time (i.e., among the alternatives relevant to ascriptions of freedom and of moral responsibility). And, as I've noted above, on this question the controversy continues to rage on. As with the Frankfurt and conditional analysis compatibilists, however, the altered-law and altered-past compatibilists are jointly committed to the claim that the apparent manifestation of conscious states and psychological properties (that stand behind the backtracking counterfactual and claims about what the alleged agent is able to do) are genuine. After a final remark about the last remaining strategy for compatibilism, I will attempt to show that this extra commitment spells trouble for any attempt to take the well-known compatibilist strategies out of their traditional contexts into our new puzzle of mirror determinism.

But first, what of many-brothers compatibilism? There are some straightforward similarities between many-brothers determinism and mirror determinism, inasmuch as the conditions which fix the local facts in both theories can depend on the behavior of a numerically distinct free agent. (Recall that this was a salient feature of surface determinism, as well.) Once again, consider the principle denied by the many-brothers compatibilist:

(PP): If (i) *A*'s freely doing *x* at *t* entails *B*'s doing *y* at *t*, and (ii) *B*'s doing *y* at *t* entails *A*'s doing *x* at *t*, and (iii) *A* freely does *x* at *t*, and (iv) *A* is distinct from *B*, then (v) *B* does not freely do *y* at *t*.

Although it seems very plausible to me, I have elsewhere offered my opposition ammunition by suggesting a counterexample to (PP) that exploits the double entailment present in many-brothers determinism scenarios—simply “substitute ‘Alice’ for ‘*A*’, ‘votes for the same candidates as Hannah’ for ‘doing *x*’, ‘Hannah’ for ‘*B*’ and ‘votes for the same candidates as Alice’ for ‘doing *y*’ ” (Hudson 2001*a*: 43–4). But I remain less than confident that exploiting an action description whose content explicitly reports the actions of individuals other than its agent really

diminishes the intuitive force behind (PP) or the weaker principles to be discussed below. Since there is no double entailment in the mirror determinism case, the relevant principle on which we might focus could be somewhat weaker.

(RP): If (i) *A*'s freely doing *x* at *t* entails *B*'s doing *y* at *t*, and (ii) *A* freely does *x* at *t*, and (iii) *A* is distinct from *B*, then (iv) *B* does not freely do *y* at *t*.

Recognize that I am here assuming that the caster is acting freely, but only to make things as difficult as I can for the would-be compatibilist. I have elsewhere (Hudson 2000*a*) offered counterexamples to principles like (RP) such as this one: "suppose that Hannah freely claps her hands at T and that Hannah is not God. But in every metaphysically possible world in which Hannah freely claps her hands at T, God permits Hannah to clap her hands at T. Now, substitute 'Hannah' for '*A*', 'God' for '*B*', 'clapping her hands' for 'doing *x*', and 'permitting Hannah to clap her hands' for 'doing *y*', and we have our counterexample. Clearly, God's permitting Hannah to clap her hands at T is an exercise of Divine freedom" (Hudson 2000*a*: 42).

A less vulnerable but just as valuable principle for our purposes might instead read:

(VP): If (i) *A* causes *B* to do *y* at *t*, and (ii) *A*'s causing *B* to do *y* at *t* is unavoidable for *B* at *t*, and (iii) *A* is distinct from *B*, then (iv) *B* does not freely do *y* at *t*.

Recognize that I am now assuming that mirror determinism (like causal determinism and unlike theological determinism) is a causal process, but this assumption should be unproblematic. Whereas (VP) avoids the counterexample of Hannah and God, (VP) would still appear to threaten the freedom of a mirror-determined object. But invoking (VP) puts us squarely back into the discussion of altered-law and altered-past compatibilism, each of which would attempt to show that condition (ii) is not always satisfied by mirror-determined objects.

On the strength of the review above, it would seem that mirror compatibilists might mount a defense with some of the standard strategies invoked by their counterparts addressing threats from other determinisms and might hope for a similar measure of success. In the remainder of this section, though, I would like to present and defend a reason to think that either they will not be as successful as their

counterparts or else both (i) a rather bizarre (though increasingly popular) view of the metaphysics of persons is true while (ii) a theory of *de re* temporal predication associated with that theory is false.

As I indicated above, any attempt to adapt the familiar compatibilist ploys outlined and discussed above would require ascribing to the mirror-determined object genuine thoughts and intentions, choices and deliberations, and a variety of psychological properties and capacities. But, as earlier noted, a mirror image need not be (in Chapter 4's language) a *proper continuant*, since it does not require causal interconnections between its temporal parts, but rather enjoys a unity imposed on its temporal parts in the form of the relation 'being dependent upon on the same caster as'. Moreover, even though in non-deviant scenarios (e.g., those not involving seamless, demon mirror replacement and the like) the later temporal parts of images almost always have some causal dependence upon their earlier parts, this dependence is not sufficient to ground the ascriptions of the relevant genuine psychological properties and capacities.

Here's what I have in mind. Given that I take an image (in non-deviant scenarios) simply to be identical to a proper spatial part of a proper temporal part of a mirror, and since I take mirrors to be governed by the restriction that their temporal parts are immanently causally interrelated, I thereby assume that this is an actual and contingent feature of most images, as well. The telling difference, as remarked earlier, is a modal one. The image could survive the right kind of mirror replacement, whereas the mirror could not. (And once again, the appearance of contradiction in these claims can be replaced with the controversy of counterpart theory. But I think that is a good trade.) Accordingly, there are the right kinds of causal dependence relations to ground judgments about the object (*qua* mirror) persisting across time; that is to say, the features of the object in virtue of which it is a proper part of a mirror at a later time are causally dependent in just the right way on the features of the object in virtue of which it is a proper part of a mirror at earlier times. Unfortunately, the features of the very same object in virtue of which it is also an image at a later time are not causally dependent on the features of the object in virtue of which it is also an image at earlier times. Rather, the image depends for those features in virtue of which it is a persisting image not on its earlier temporal parts, but instead on the earlier temporal parts of its caster. But

this characteristic spells trouble for the project of showing that a three-dimensional reflection (should there be any in four-space) could also be the subject of genuine psychological properties and capacities, no matter how much it resembled such a thing.

Consider for a moment the four-dimensionalist's metaphysics of temporal parts. A human person, on that view, is a fusion of uncountably many, momentary person-stages. Each stage is fully determinate at the one and only moment it exists, and they jointly have the distinction of being stages of one and the same person. It is easy to imagine, however, a second series of person-stages, paired one–one with the original series, the members of each pairing qualitative duplicates of one another. The salient difference, then, is that whereas in the second series there is spatio-temporal continuity, there is no causal dependence of the later stages on the earlier ones, and hence the second plurality does not enjoy the distinction of being stages of one and the same person. Any outside observer might well think otherwise, but this would be a mistake worthy of forgiveness, for the fusion of the items in the second series would give every appearance of being a person.

Now any three-dimensional, mirror-determined object would be very much like the apparent person just described. It, too, would be a fusion of momentary person-stages which lacked the right kind of causal dependence to be stages of one and the same person (even if they managed to exhibit the right kind of causal dependence to be stages of one and the same proper part of a mirror). Why would this apparent person not be the subject of genuine psychological properties and capacities? Because certain causal connections feature among the conditions under which thoughts can have their requisite unity and capacities can be borne by subjects, and by hypothesis those very causal connections are here absent.

One intriguing possibility remains, however. Recently, Ted Sider has championed what he calls 'the stage view' according to which (strictly speaking) human persons are momentary entities; in general, Sider is a proponent of a four-dimensionalist, universalist metaphysics, but rather than identifying a human person with a certain cross-time fusion of momentary person-stages—a so-called spacetime worm—he instead takes them to be identical to what an orthodox four-dimensionalist would assume is an instantaneous proper temporal part of a persisting person (Sider 2001; see also Hawley 2001). The case for this apparently

outrageous view is better than one might suppose, and Sider does an excellent job of motivating the theory despite its counter-intuitiveness.

One rather obvious objection to the stage view is that it would seem to deny any human person a past or future—and to the extent that this interferes with manifesting genuine psychological properties and capacities (as argued above), it would also, for example, block the ascription of beliefs to human persons. And, surely, that would be too much to bear. Sider, however, has an ingenious response to this complaint. As he puts it:

Having a belief does indeed require *having had* certain features in the past. This is not inconsistent with the stage view, which interprets the past having of the relevant features as amounting to having temporal counterparts that have those features. In order to have a belief, a stage must stand in an appropriate network of counterpart relations to other stages with appropriate features. Thus the property *having a belief* is a highly relational property. It nevertheless can be instantiated by instantaneous stages. (Sider 2001: 197–8)

In other words, Sider offers a counterpart theory of *de re* temporal predication for stages that borrows directly from the widely discussed and increasingly popular counterpart theory of *de re* modal predication. On this view, the truth conditions for an utterance at noon of “Hannah once hit a grand slam” are that there is some momentary person-stage (or fusion of person-stages) all confined to times earlier than noon that (perhaps jointly) hit a grand slam and that (individually) bear the temporal counterpart relation to Hannah. Similar truth conditions can be articulated for future-tensed utterances. Moreover, when pressed for an account of the temporal counterpart relation, a stage theorist can simply borrow whatever unity relation the orthodox four-dimensionalist already recognizes for those items that he regards as stages of one and the same persisting person. Significantly, whereas there is a good deal of controversy about just how to analyze this relation (especially concerning whether it should respect biological or psychological criteria), there is at least widespread agreement that a minimal condition in play is the kind of immanent causal interrelatedness that was driving our discussion above.¹⁷

Can the stage view help in our present predicament? Well, it would permit momentary reflection-persons, and so we have some assistance

¹⁷ For an exercise designed to show that the biological emphasis is the wrong one, see my 2006.

there. But since the momentary reflection-persons do not stand in the causal relations that an orthodox four-dimensionalist thinks necessary for gen-identity, they also do not stand in Sider's temporal analogue of the counterpart relation, and thus his theory of *de re* temporal predication cannot be used to rescue ascriptions of thoughts and experiences to the reflection-persons. This defect can be remedied at further cost, however. It is, of course, possible to separate Sider's stage view and its dependence on a counterpart-theoretic account of *de re* temporal predication from his particular characterization of the counterpart relation at issue. To be clear, if one were to side with the stage theorist, I think one would do well to endorse the version of the counterpart relation offered by Sider and be done with it; but I think it interesting to pause long enough to describe the amendment needed to adapt the stage view to the ends of the mirror compatibilist—namely, the mirror compatibilist would simply need to put forth a counterpart relation that is satisfied when two momentary entities stand in the 'is a temporal part of the same image as' relation, which, as we have noted, is partially determined by the 'is a reflection of the same caster as' relation. But perhaps we have now gone far enough to summarize.

I submit that mirror determinism is a new and intriguing kind of local determinism worth considering, should we live in a plenitudinous hyperspace. I further submit that establishing that a given reflection is in fact mirror-determined is a much easier task than establishing of some object that it is subject to causal determinism, theological determinism, logical determinism, or many-brothers determinism. Whereas there are many different strategies for compatibilism for a given kind of determinism and free will (or moral responsibility), the prospects for adapting the more plausible of these strategies in the case of mirror determinism is much dimmer than elsewhere, for not only must the would-be compatibilist mount a defense of (for example) the already controversial ability claims and backtracking conditionals of altered-past or altered-law compatibilism, but she must also appeal to the stage view of human persons and to a rather *ad hoc* account of the temporal counterpart relation. For these reasons, although I side with the compatibilists when confronting causal, theological, and logical determinism, I cast my vote for the incompatibilists not only in the case of many-brothers determinism but in that of mirror determinism as well.

7

Hyperspace and Theism

§1 The Problem of the Best

In Chapter 1 I investigated some nontheistic reasons for believing in hyperspace, and I would now like to close this work by turning my attention to some explicitly religious reasons for believing in hyperspace. In this chapter, I will examine some lines of thought that appeal to common theistic themes (without specific reference to Christianity), and in the next chapter I will examine some reasons that are much more likely to appeal to theists who are also Christian; but I shall nevertheless pursue each of the investigations from the standpoint of an interested Christian participant. As before, I am here concerned only with philosophical (as opposed to physics-based) reasons, and I make no pretensions to comprehensiveness. Instead, I propose to look in some detail at a handful of problems that I think can lend some credence to the hypothesis of hyperspace for those who already accept the presuppositions that motivate them.

I would first like to address a problem which has well-known historical roots in the writings of Augustine, Aquinas, and Leibniz (among others), and which has sparked a lively contemporary debate in the writings of Pike (1963), Penelhum (1967), Adams (1972), Quinn (1982), and Rowe (1993), among others. Here is an initial statement of the problem I have in mind.

One rather plausible expectation of a being who is essentially omnipotent, essentially omniscient, and essentially perfectly good is that this being create the best possible world. However, the amount, the types, the intensity, and the distribution of evil we see around us seem to point rather overwhelmingly to the conclusion that ours is most certainly not the best possible world. So, if things are as they seem, the

theist who ascribes to God those attributes is in trouble. Two traditional responses to the problem are as follows: (i) appearances to the contrary notwithstanding, God does not have to create the best possible world, after all, and (ii) appearances to the contrary notwithstanding, this is indeed the best possible world, and the amount, types, intensity, and distribution of evil to be found in our world (or else something equivalent to it) are really an indispensable element of the best of all worlds, after all.¹

I have left out a good deal of information in that initial statement. A more careful look will reveal that the problem seems to presuppose a number of potentially troublesome assumptions which, if they were to be rooted out and exposed as false, might serve to eliminate this puzzle altogether. For instance, it seems to presuppose at least the following five controversial claims:

(CC1): An essentially omnipotent, essentially omniscient, essentially perfectly good being must create some world or other.

(CC2): Worlds are the sort of things that can be the bearers of value.

(CC3): The values of worlds are commensurable.

(CC4): There are no ties for "first place" in value among the worlds.

(CC5): There is no infinite hierarchy of worlds such that for any world, there is always a better one.

Before I suggest a solution to this problem, some comments on these presuppositions are in order. First, even if God were to refrain from creating any contingent thing, still God would thereby be partially responsible for the existence of a world. It would then just be a world consisting of God and the necessary abstracta, but devoid of any concreta. So, in whatever sense God can be said to be responsible for creating some world or other, (C1) would appear to be a truth.²

Next, one might maintain that there is no such thing as the value of a state of affairs (or of a world) *simpliciter*, but instead hold that the value

¹ Adams (1972) is in favor of the first strategy; Quinn (1982) and Rowe (1993) are opposed. Leibniz and Pike (1963) are in favor of the second strategy; Penelhum (1967) is opposed.

² Of course, one's view of the extent to which God's creative power can fix the features of a world may depend on one's stand on the compatibilism/incompatibilism debate and one's view about just what divine activities are consistent with a community of free beings. My present purposes don't require taking sides on this issue, and I here happily pass over that complication.

of a state of affairs is always relativized to agents and projects, in which case we would have to face the question, "Just which agent and what end do we (or does God) appeal to in order to assign values?" Moreover, one might maintain that even if there is a way of ascribing value to a world or to its parts without reference to agents or projects, not all types of value would be relevant in an essentially omnipotent, essentially omniscient, essentially perfectly good Being's decision regarding which world to create (e.g., perhaps moral value would be relevant, and aesthetic value irrelevant). Quinn, who discusses this latter issue, has also raised worries about the analyses of comparative relations such as 'is a better world than', pointing out that the plausible supposition that such a relation would be asymmetric, transitive, and irreflexive would guarantee only a strict partial ordering on the set of worlds. This, of course, would leave open the possibility that assumptions (C4) and (C5) above, assumptions which are designed to help ensure that there be a single best world, might well be false.³

The complaint about ties for best-world honors is easily remedied. We can let the phrase 'unsurpassable world' pick out any number of worlds, each of whose value is commensurate with the value of every other world, and each of which is such that no other world exceeds it in value. The original problem could then be recast as the conflict between the requirement that God create one of the unsurpassable worlds and the discovery of certain evils in our world that seem to disqualify it for that honor.

The complaint about the infinite hierarchy of value among the worlds, however, is not so easily dismissed. If there is such a hierarchy, then there is neither a best world nor a collection of unsurpassable worlds. In this case, the problem would take a significantly different turn. One might declare that this is good news for the theist, since it is no defect in God that God does not create the best world (granted the assumption that this is an impossible task). Alternatively, one might declare that this is bad news for the theist, since it would appear that no matter how good the try, God's creation and the quality of God's moral character could both be surpassed.⁴

³ See Quinn 1982: sect. II. Quinn himself attempts to construct a version of the problem currently under investigation using only the minimal assumption that the set of worlds be strictly partially ordered.

⁴ Rowe 1993 provides an interesting discussion of this pair of responses. Also see Howard-Snyder and Howard-Snyder 1994. The Howard-Snyders argue that even if God

Admittedly, these assumptions are fascinating in their own right and deserve careful attention, but given the specific focus of this section, I will restrict my attention to a version of the problem which presupposes that God must create, that worlds have values, that they are commensurable, and that no hierarchy is in place which prohibits a best.

So how does the thesis of a plenitudinous hyperspace help the theist provide a satisfactory solution to the problem of the best? Note that the alleged incompatibility which seemingly threatens the theistic position (described above) relies on an unstated assumption: namely, that if God exists, then God creates exactly one world. Now if God's creation is limited to exactly one world, and if God must create either the best world or an unsurpassable world, and if our world is neither best nor unsurpassable, then our theist will be defenseless. The plenitudinous hyperspace theorist, by contrast, is in the remarkable position of being able to maintain that there is a perfectly serviceable sense in which God creates more than one world. We have to be careful, though. Traditionally, 'world' in this discussion is short for 'possible world' and in talking of other possible worlds we are talking of maximal alternatives to the actual world. I am not currently suggesting that the proponent of a plenitudinous hyperspace should maintain that the many distinct and independent regions offered by his metaphysics are 'ways our world could have been' or that a reductive analysis of modality is in the offing.⁵ Rather, I am suggesting merely that the many independent regions of a plenitudinous hyperspace provide this theorist with the resources to affirm a perfectly good sense in which both God creates the best world and our own world is not the best. The sense in question amounts to the double claim that at least one of the independent three-dimensional subregions of hyperspace is as valuable as any three-dimensional subregion could be, and that the particular three-space in which we find ourselves is not the fortunate one. In fact, the thesis of a plenitudinous hyperspace can produce richer consequences still, for it also provides the resources to maintain a straightforward sense in which God creates

were to create a surpassable world, one would not be able to infer straightforwardly (as both Rowe and Quinn attempt to do) that there could be a morally better agent than God.

⁵ Compare Lewis 1986 and his reductive analysis of modality proposed in terms of the many Lewis worlds.

absolutely every world worth creating, even if their number is indenumerable.

Objection: That doesn't get to the heart of the original problem. The real perplexity is that given that there are alternatives to actuality that are better than what we have, why didn't God ensure the existence of one of those maximal possible scenarios instead? Your talk of a plenitudinous hyperspace (at best) just maintains that actuality is bigger than we thought it was—but so what? Why isn't there, for example, a completely different hyperspace, every subregion of which is better than the miserable one in which we have to eke out our existence?

Reply: There are two different ways of thinking about this. *First question:* why didn't God create a three-space that was much better than ours? *Proposed answer:* God did, and it is located at some determinate spatial distance from you now, and God created yours, too, and somewhere or other God has created every three-space worth having. *Second question:* why didn't God ensure the existence of a possible world that was much better than our actual world—e.g., a hyperspace every independent subregion of which was as valuable as a subregion could be, rather than a hyperspace only some of whose subregions are as valuable as a subregion could be? *Proposed answer:* because even though each independent subregion of the proposed possible alternative would be at least as good as or better than each of the independent subregions of the actual world, the world itself would be inferior. That is to say, whereas the “local comparisons”, so to speak, would seem to favor the proposed possible alternative, the “global comparisons” would favor the world we have. Allow me to elaborate just a bit on this idea, which, like Leibniz's, is a version of the reply “perhaps the actual world is an unsurpassable world after all,” but which, unlike Leibniz's, can ground this reply by drawing upon the value manifested at each of the subregions and in the hyperspace as a whole.

Presumably, the main reason for thinking that a hyperspace which included among its independent subregions every three-space worth having would be preferable to a hyperspace every independent subregion of which was maxed out in value, would simply be that there is something tremendously good about the diversity in the former scenario which would be altogether missing from the latter, a kind of appeal to the ancient idea of “a great chain of being” in which every configuration consistent with God's nature is realized in some concrete way in some region or other.

But diversity is not the only global feature that might favor a hyperspace with regions like ours. Another feature that strikes me as particularly promising is a reduction of bruteness and arbitrariness in the world. David Lewis won precious few converts to his bold thesis of the existence of many spatio-temporally and causally isolated concrete universes (which he championed on the grounds of theoretical unity and economy), but one exception was Peter Unger, who attempted to show that Lewis (1986) had overlooked or underemphasized one line of support that could be generated by observing that the proposed plurality of worlds reduced appeal to brute facts in a very satisfying way (Unger 1984).⁶ For example, in response to the inquiry, “Why does the universe require that light travels at roughly 186,000 miles a second rather than 93,000 or 372,000 miles a second?”, we may be told that the universe doesn’t require any such thing, for there is a region in which the first speed limit is in force and other regions in which the other restrictions are in force instead. Alternatively, “Why is gravity roughly 10^{39} times weaker than electromagnetism, rather than 10^{38} or 10^{40} times weaker?” But it *is* 10^{38} times weaker *over there* and also 10^{40} times weaker at other places and yet other relational values at other regions. And so on—i.e., like responses reintroducing nonarbitrariness may be manufactured for the great range of similar questions that would address some apparently quirky or oddly peculiar feature of the universe. Unlike Unger, I do not wish to press the advantage of reducing arbitrariness as a way of advocating a full-blown thesis of spatio-temporally and causally isolated universes, but rather simply to reframe it as a somewhat attractive incentive to take seriously the hypothesis of a plenitudinous hyperspace.

One more reflection on this topic: one might have taken this argument from reducing bruteness and arbitrariness in the world to a hypothesis of a plenitudinous hyperspace to have been equally at home in Chapter 1 with the nontheistic reasons for that view. Why include it here among the theistic reasons? I think the answer to this question takes us into very difficult waters. I am regularly surprised to

⁶ Unfortunately (say I), Lewis claimed to be “inured to brute contingency” (1986: 129) and took Unger’s efforts to eliminate arbitrariness by appeal to a plurality of worlds as something of an objection rather than as the friendly supporting gesture that Unger apparently intended it to be.

see (i) the seriousness with which scientists embrace the directive to eschew bruteness as a regulative principle when conducting their business; (ii) how often the course of contemporary science is redirected by a desire for harmony, simplicity, and unification; and (iii) how frequently aesthetic properties such as beauty and elegance are invoked as crucial selection principles when evaluating physical theories (see, e.g., the discussion in Weinberg 1993: 132–65). But whence the confidence in the immensely popular worldview that the universe presently hides a harmonious and beautiful structure that can be captured by simple and elegant laws, magnificently unifying what would otherwise appear to be a very wide range of rock-bottom, brute facts? On the contrary, why not presuppose that bruteness is everywhere, and hold that much of the effort and expense currently lavished on the quest for unification is simply misdirected and wrongheaded? As I mentioned in the Introduction, it is one of the scandals of contemporary philosophy (and physics) that so little work has been done on the question of distinguishing those facts that can reasonably be taken to be brute from those which cry out for further investigation. I am not at all convinced that there is sufficient motivation for such widespread conviction that our world conceals the kinds of features that our contemporary science presupposes are there to discover. Unless . . . one takes the relevant features of the world to have been fixed by something that favors harmony to discord, beauty to grotesqueness, elegance to gracelessness. The theist who takes those cosmic features to be fixed by an essentially perfectly good Being and who relies upon not unreasonable connections between perfect goodness and the goal of producing harmony, beauty, and elegance in creation has a story to tell. It is the theist, then, with her straightforward and compelling explanation of why we should anticipate the world to manifest such wonderful qualities whom I think should be moved by an argument from reducing bruteness and arbitrariness in the world to a hypothesis of a plenitudinous hyperspace. Given the nearly universal conviction described above, I would predict that many (if not most) nontheists are likely to be moved by these advantages as well, but with considerably less justification.

Objection: the assumption mentioned earlier which denied the hierarchy of valuable worlds is really too much to bear. As Aquinas once argued, and as Kretzmann recently seconded, there just is no world that

cannot be exceeded in value; for any world God might create, there is always a better.⁷ But without this assumption there is neither a best world nor a set of unsurpassable worlds, and without such a world or set, there is no problem of the best to be solved.

Reply: With our appeal to hyperspace, the assumption doesn't really matter as much as one might think. Suppose we simply grant that the assumption is too controversial to be relied upon. Let us then proceed by taking cases. First, grant that there is a best world or else a set of unsurpassable worlds. The plenitudinous hyperspace theorist can then affirm that God creates the best (if there is one), all the unsurpassable worlds (otherwise), and many other surpassable worlds (that are nevertheless worth creating) to boot. Second, grant that there is a great infinity of worlds none of which is unsurpassable. Once again the plenitudinous hyperspace theorist can affirm that God creates an infinity of worlds (beginning with the very first world or set of worlds equivalent in value that are worth creating), even though each is surpassable. In this case, the familiar objection that if God were to create a surpassable world, then God's creation and God's character could both be surpassed would no longer be successful, since that objection presupposed that God's creative activity is limited to exactly one world. Incidentally, recall (and then deny) another of the problematic assumptions mentioned earlier which, likewise, may now not turn out to matter as much as one might have thought (i.e., let us now suppose that the worlds have values which are not commensurable). Once again, the proponent of a plenitudinous hyperspace can affirm that God creates all of the worlds that are worth creating in themselves, even if no comparative judgments of worth among the worlds is forthcoming. In each of these cases, I submit, the creative output we would expect from an essentially omnipotent, essentially omniscient, essentially perfectly good Being is much better accounted for by the proponent of a plenitudinous hyperspace than it is by the proponent of a lonely three-space.

A final thought on this matter: one popular theistic assumption is that God has a choice regarding just which world to create, or more cautiously, that for some special set of worlds that all satisfy a certain minimal criterion of value, God is free to create or to refrain from

⁷ Aquinas addresses this issue in his *Summa Theologica*, part I, q. 25, art. 6. For the revival, see Kretzmann 1990a and b.

creating any world in that set.⁸ I do not mean to deny this assumption in its entirety (i.e., what I will say is consistent with God's selecting a particular hyperspace world from a pool of uncountably many metaphysically possible worlds), but I do mean to explore a denial of one of its common interpretations. Let us, then, entertain the thought that the divine nature requires God to create absolutely every world worth creating (where once again 'world' takes on its meaning of an independent region in hyperspace and not its shorthand role for 'possible world'). Recall the quotation from Kant in Chapter 1:

[A] science of [spaces of more than three dimensions] would undoubtedly be the highest enterprise which a finite understanding could undertake in the field of geometry. . . if it is possible that there are extensions with other dimensions, it is also very probable that God has somewhere brought them into being; for His works have all the magnitude and manifoldness of which they are capable. . . [such higher spaces would] not belong to our world, but must form separate worlds. (1747: 24–5)

Accordingly, it would not be in God's power to create regions not worth creating nor to refrain from creating regions worth creating. God's freedom would not be completely curtailed, however, since God might still enjoy a fair amount of significant freedom regarding his interaction with the denizens of those created regions. Moreover, let me suggest that one of the primary motivations for the belief that God has a genuinely free choice regarding just what to create is generated only on the double assumption that God's creative activity is restricted to exactly one world and that without God's possessing a genuinely free choice in this matter we would not be able to explain why we have our own dismal world rather than the best world or an unsurpassable world in its place. If we are to some extent able to undermine that pair of assumptions with the thesis of a plenitudinous hyperspace, then we no longer have a pressing reason to believe that God is free in this particular respect as well as being free in other respects. Finally, any alleged loss of freedom in choosing whether to create some lonely three-space world would be more than compensated by the fact that the divine Being's nature would be sufficient for the existence of not just one valuable three-space region, but of the great infinity of three-space regions worth creating.

⁸ Some suggestions concerning the minimal conditions for membership in this set are offered in Adams 1972.

§2 The Problem of Evil

Let 'E' be a proposition that precisely describes the amount, the types, the intensity, and the distribution of all the so-called natural evil consisting in the suffering of (nonperson) animals that has ever occurred in the history of our universe. Let 'G' be a proposition that asserts the necessary existence of an essentially omnipotent, essentially omniscient, essentially perfectly good Being. In the well-established tradition of those who believe that proper reflection on the problem of mere animal suffering can lead to a denial of the existence of God, let us put an initial question to a philosopher who affirms G: "Do you agree that there is such a proposition as E and that some of the conjuncts of E assert the existence of and describe genuinely horrific evils?" And let him not hide behind some grossly implausible claim that our mistaken impression that the world contains evil is simply due to our limited powers of insight into the real value of things. In other words, let him answer with a simple and straightforward "Yes".

Further, let us ask our theist to endorse a conditional: "Do you agree that the conjunction of E and G is true only if there exists a compensating good for the evils described by E—i.e., only if some state of affairs, *s*, obtains and is such that (i) for any state of affairs, *s*^{*}, if *s*^{*}'s obtaining is equivalent in value to or better than the obtaining of *s*, then it is metaphysically necessary that *s*^{*} obtains only if some state of affairs equivalent in value to or worse than that described by E obtains; and (ii) the obtaining of *s* is so valuable that it sufficiently compensates for the disvalue of the obtaining of the state of affairs described by E?" And once again (although the pressure to give an affirmative answer here is less severe than before, owing to such demanding constraints on 'compensating good'), let him reply with a simple and straightforward "Yes".

Finally, in an attempt to get him to relinquish his endorsement of G, let us ask our theist: "Do you agree that some of the conjuncts of E describe genuinely inscrutable evils?—i.e., evils for which we can identify no such compensating good?" And once again (although the pressure to answer in the affirmative continues to decline), let him present himself as a target with another simple and straightforward "Yes".

Despite his willingness to give so much ground, any claim of victory over our theist would be premature at this juncture.⁹ After all, conceding an inability to identify a compensating good for some acknowledged evil is not itself a concession of the non-existence of such a compensating good, and it is the latter, not the former, concession that would spell trouble for our unusually agreeable theist. In order to move so directly from our inability to identify a compensating good to its non-existence, we would need a bridging principle:

(A): If there were a compensating good for the evils described by E, then we would be aware of it and would identify it as such.

Demonstrating (A) is a daunting task. But perhaps our theist's opponent can reasonably proceed with something seemingly easier to defend:

(B): It is very probable that if there were a compensating good for the evils described by E, then we would be aware of it and would identify it as such.

And perhaps the most tempting route to a defense of (B) comes by way of backing an anti-skeptical premise:

(C): We have good reason for thinking that the possible goods we know of are representative of the possible goods there are.

As an alternative to defending either (A) or else (B) and (C) and then making use of our theist's confessed inability in order to drive him to either inconsistency or unreasonableness, the theist's opponent might instead simply make a direct case for the non-existence of a compensating good for the evils described by E, and then infer the negation of G from E together with the need for (but lack of) a relevant compensating good.

In this section, I propose to assist the theist who is willing to give so much ground. In fact, the generosity of our theist (let us imagine) need not stop here. He is also willing to relinquish the thesis that (causal) incompatibilism is true, and thus (according to many of his cohorts) is

⁹ Of course, the theist *need not* have given so much ground. For instance, a free will theorist who makes use of genuine risk or recalcitrant counterfactuals of freedom would countenance possible worlds having more good and less evil than ours, owing to features of the world outside God's control. But the theist I have in mind is in a giving mood, and I am interested in just how expensive his gift really turns out to be.

reckless enough to jeopardize even the so-called free will defense, as well. (Although appeals to natural evil are often designed so as to sidestep worries about the free will defense, those worries reappear as soon as one entertains the epistemic possibility that the suffering in question may be the result of the misuse of freedom by creaturely, nonhuman persons. Just to be on the safe side, then, let's explicitly close this route of retreat, as well.)

My strategy for assisting the theist willing to give so much ground consists in presenting a metaphysically possible state of affairs whose obtaining could serve as a compensating good for the evils described by E. Moreover, I will provide good reasons to think (i) that (for all anyone knows) this state of affairs does obtain and serves as a compensating good, thus blocking the claim that we *know* that there is no such compensating good; (ii) that it is not very probable that if it were such a compensating good, then we would be aware of it and would identify it as such, thus *diminishing* (if not eliminating) any threat to the theist from (B); and (iii) that one prominent reason to endorse the claim that we have good reason to think that the possible goods we know of are representative of the possible goods there are (i.e., the we've looked long and hard defense) is inadequate, thus *diminishing* (if not eliminating) the prospects for a defense of (B) by way of establishing (C). I have no further ambitions for this section; it certainly contains nothing so grand as a theodicy or a defense of G.¹⁰

The Museum Curator Story

A warm-up exercise will prove helpful. Suppose you are to visit the Museum of Wondrous Things. Rumor has it that the museum's west

¹⁰ The volume of literature on the so-called Problem of Evil is staggering, and representative citations are becoming unmanageable. Still, excellent work has been done and should be acknowledged. I think the strongest atheistic case which falls under this many-colored heading is what is known as the evidential argument from evil, superb discussions of which can be found by authors such as Alston, Draper, Gale, Howard-Snyder, Plantinga, Rowe, Russell, Stump, Swinburne, van Inwagen, and Wykstra, in Howard-Snyder 1996. The present chapter is in the tradition of those just cited and presupposes a modest background, but then veers off sharply in an unexplored direction. Of course, theses (A), (B), and (C) have come under heavy scrutiny in these debates, with variants of (B) and (C) often taking center stage. For a careful and penetrating exchange on (C) in particular, see Bergmann 2001 and the reply in Rowe 2001.

wing is under the watchful eye of the ever-vigilant supreme artist. The supreme artist (if he exists at all) has total power over the existence and properties of any and all material objects in the west wing, knows all there is to know about how to bring it about that a given material object inhabiting the west wing exemplifies the finest aesthetically valuable properties that it is possible for that object to exemplify, and is motivated by his very nature to prevent or eradicate aesthetic disvalue as well as to create or maintain aesthetic value.

The problem is that the supreme artist (if he exists at all) seems to keep himself well hidden (or at least, many visitors profess not to see him), and thus doubts about his reality surface from time to time.

The day of your special visit arrives, and upon entering the Museum of Wondrous Things, you make straight for the west wing. But as you walk down the corridor, you are startled to pass what appear to be a series of rather nondescript paper-like cutouts wholly devoid of any aesthetic interest. Worse yet, as you move further into the interior of the west wing, you begin to wince at the rather ungainly and ridiculous flat figures you encounter at every turn. And finally (after some real investigating) you find yourself thoroughly repulsed by what you clearly recognize as some of the ugliest silhouettes you could have imagined—horrific uglinesses.

Sorely disappointed by your experience, you nevertheless take some satisfaction in thinking that you learned one thing that made the visit worthwhile—that there's no supreme artist who cares for the west wing! If he did exist (as described), what in the world could explain his permitting *this* aesthetic monstrosity or *that* one?

Before you can storm out of the west wing with your newly acquired opinions, however, your companions confess that they have played a practical joke on you. It turns out that they fitted your glasses with special lenses, lenses which show only a two-dimensional cross-section of any three-dimensional artifact which happens to be lit by the kind of lights found only in the west wing. After finding your reserve pair of glasses, you are able to see a collection of beautiful—stunningly beautiful—three-dimensional statues. In your new condition, it takes some concentrated exercise of the imagination to remember the two-dimensional cross-sections you so recently took for the whole of the artistic pieces, but their presence (safely embedded in marble) seems of small consequence now. Moreover (although the supreme artist who is in fact

watching over your shoulder doesn't bother to explain this to you), it turns out that it is metaphysically necessary that aesthetic value of the sort had by the statue in front of you is realized in the world only if there is something aesthetically equivalent to or worse than the two-dimensional cross section you viewed with your modified glasses. In other words, the horrific and inscrutable ugliness you saw moments ago was not a pointless ugliness—for it had a compensating beauty.

After some reflection, you come to realize that not every $n-1$ -dimensional cross-section of an n -dimensional object need have the same aesthetic status as its host. A plurality of uglinesses may have a beautiful fusion.

A reminder: the goal I set for myself earlier was to present a metaphysically possible state of affairs whose obtaining could serve as a good compensating for the evils described by E. I have no desire to show that we have reason to think that the state of affairs to be presented actually obtains—or even that it is probable that it obtains, given G. A generalized version of the lesson just extracted from the Museum Curator Story will soon play a central role in my attempt to accomplish my primary goal.

The Hermit Flatlander Story

Another useful warm-up exercise. Imagine a hermit in Flatland. Flatland is a two-dimensional plane space (i.e., a tile-shaped space, not a sphereshell-shaped space). The two-dimensional inhabitants of Flatland may move right and left or forth and back, but not up and down (at least not by their own power). The hermit prides himself on keeping at least eight inches away from any other polygon. But alas, our hermit doesn't realize that the plane on which he lives and moves is but one of an uncountably infinite stack of such planes. Our unfortunate hermit is embedded in three-space and has no idea that he is (at this very moment) only an inch from another hermit similarly confined to her plane (i.e., confined to a plane parallel to and an inch from our hermit's). Our hermit can acquire no evidence of this proximity through any investigation of his own, however, and so never becomes anxious about his condition. Still, even though our hermit cannot point or move in the direction of the offending neighbor, he is in fact at a distance from her which is measured in the same units used to mark his distance from his own fellow Flatlanders.

Now suppose that you and I are embedded in four-space, yet live and move about in our own three-space cross-section. This supposition, I maintain, is metaphysically possible. By analogy with our hermit's predicament, there is a direction in which neither you nor I can point or move, and along that direction are stacked uncountably many, non-overlapping three-spaces. Here's the surprising bit: choose some object in your visual field that lies only eight inches away from your eyes. In that mysterious direction to which you can neither point nor move, there are uncountably many, non-overlapping, big-as-you-please, three-dimensional regions, each of which has some subregions (and each of which may sport some inhabitants) that are closer to you than is whichever object you chose from your visual field. *Closer* in exactly the same units of measure, too—just inches away. Such recreational opportunities so close at hand! Of course, you might not be able to get to them (despite their proximity) without the help of some good-natured four-spacer—but don't ask for help. Unless he has truly miraculous powers, he'll never get you back home. Note that you or I could move our hermit out of Flatland and into another space, but we'd have an awful time getting him back in his original plane. There are uncountably many targets, after all.

A first attempt to apply the lessons: the good,
the bad, the beautiful, and the ugly

In reverse order from the section heading, first recall the metaphysically possible four-space which consists of uncountably many, non-overlapping, big-as-you-please, three-spaces. Suppose that one of the four-space subregions of this four-space (a subregion that extends only a few feet in that direction in which neither you nor I can point or move) contains three-space cross-sections each of which confines several inhabitants. Further, suppose that among the prisoners of these three-spaces, there are some fantastically ugly ones, some aesthetically indifferent ones, and no beautiful ones. Yet it is perfectly possible for some four-space artist to position one such prisoner from each such three-space so that although each prisoner remains confined to his own three-space (perhaps light-years away from any who share his prison), he is unknowingly just feet away from uncountably many strangers for whose existence and doings he can acquire no evidence whatsoever. Moreover, our four-space artist might further arrange the strangers so that despite an ugly

three-dimensional part here and there, he creates a stunningly beautiful four-dimensional statue. In fact, the Museum Curator Story could now be told one dimension up. Imagine the four-spacers playing a similar trick on their friend who visits the four-spacers' museum only to see aesthetically unimpressive three-dimensional cross-sections of four-dimensional aesthetic marvels.

That was the ugly and the beautiful. Now for the bad and the good. Perhaps it is harder to see how there might be a two-dimensional evil than it is to see how there might be a two-dimensional ugliness. Hence, in the warm-up exercises, I concentrated on aesthetics. The general lesson of the Museum Curator Story, though, seems to transfer to other kinds of value as we move from a context of two- and three-dimensional objects to a context of three- and four-dimensional objects. That is to say, just as not every $n-1$ -dimensional cross-section of an n -dimensional object need have the same aesthetic status as its host, so too, not every $n-1$ -dimensional cross-section of an n -dimensional object need have the same value as its host. Just as a plurality of uglinesses may have a beautiful fusion, so too, a plurality of evils may have a valuable fusion.

Of course, there is no need to insist on literal fusions here (although, given my universalism, I am happy to do so). We might have said that a plurality of material objects each of which is *non-F*, may be arranged in such a way that *F*-ness supervenes on certain features of the plurality (whether or not they compose anything). Or that a plurality of events each of which is *non-F* may be so structured that *F*-ness supervenes on certain features of that plurality. Moreover, one obstacle to the suggestion that a property such as being beautiful may supervene on properties had by a plurality of objects—namely, that the objects might fail to have a certain crucial proximity to one another—is simply removed in the above discussion. The relevant objects or events can be arbitrarily close to one another.

A compensating good for the evils described by E (for all anyone knows)

No one (save our theist's God) even entertains proposition E, much less *knows* E to be true. Still, we take ourselves to be painfully aware of some

of the outstanding conjuncts of E—propositions which describe horrors usually regarded as sufficiently well-qualified to drive an argument against the theist all on their own. Consider as an example, then, some long ago mammal who had the misfortune to tumble and fall into a ravine where its flesh was torn from its body by predators as it went to its death in agony.

What might we identify as a compensating good for this apparently inscrutable evil? Let us not retry the prospects of any familiar appeals to the value of freedom, or to the significance of various lessons that free creatures might learn from reflecting on such misfortunes, or to the advantage of culling the herds and preventing worse pains, or to avoiding the harms of an irregular natural order in which such things don't occur. Instead, let us look to the Museum Curator Story and to the Hermit Flatlander Story for strategy.

Suppose that our unfortunate mammal is embedded in four-space, yet lives and moves about in his own three-space cross-section (a home he shares with us). This supposition, I maintain, is metaphysically possible. Accordingly (as before) there is a direction in which neither you nor I nor he can point or move, and along that direction are stacked uncountably many, non-overlapping three-spaces. And (as before) we may further suppose that he is unknowingly so very close to uncountably many strangers (each confined to its own three-space cross-section and each just inches away). Finally (as before) we may further suppose that the event of our mammal's horrific death together with the events happening to and with and through various of his neighbors are so configured that certain value properties supervene on the plurality in question.

Which value properties? Aesthetic properties. I predict that such a proposal will seem appalling to many, but here's why it might be worth a second thought. Most of us will grant that enduring a small amount of pain (acknowledged as an intrinsic evil) might yet be compensated solely by aesthetic gain or by aesthetic gain together with assorted pleasures arising from the aesthetic gain when, for example, one experiences backache from standing stock-still in a piece of performance art or when one returns home sore from a long day of walking the exhibit at a gallery. Significantly, many of us are not likely to retract this claim of sufficient compensation even if someone were to note that the dog who

accompanied us (enjoying none of the artistic treasures) is likewise a bit sore.¹¹ Moreover, many of us will grant that the disvalue of this small amount of pain is commensurable with the disvalue of the great suffering of our mammal in the ravine—e.g., that it is, say, 1/1,000,000th as bad. But this pair of admissions suggests that we should take the following supposition seriously. There exists some state of affairs the obtaining of which is so aesthetically valuable that it could sufficiently compensate for the disvalue of the great suffering of our mammal in the ravine. Of course, not everyone will see promising prospects for a comprehensive strategy here. Regardless of the popular intuition about the disvalue of the dog's soreness being commensurable with the disvalue of the suffering of the mammal in the ravine, one might well hold that there is some type of disvalue, *K*, such that some amount of *K* could not be compensated for by any amount of aesthetic value. Perhaps this strategy will be blunted a bit by the reminder that the evils currently in question are not moral evils, but instead the sufferings of nonperson animals. Just to be clear, I am *not* suggesting that such suffering is insignificant; rather, I am merely noting that there is a better case to be made for commensurability here than elsewhere. Still, let us record this as a worry and press on.

Prior to the Hermit Flatlander Story, we might have assented to this possibility but thought it of little interest, since it is so obvious that there is no such collection of objects or events anywhere in the vicinity of the event of our mammal's death. But after internalizing the lesson of the Hermit Flatlander Story, we might be a bit more cautious. Just as our hermit could have been unknowingly only inches away from uncountably many strangers for whose existence and doings he could acquire no evidence whatsoever, so too, you and I and the mammal in the ravine could also be so surrounded—without the slightest hope of detecting our neighbors in that direction in which we can neither point nor move. Moreover, prior to the Museum Curator Story, we might have assented to this latter point too, but thought it of little interest, since it is just so hard to see what could be so valuable about a swarm of invisible things

¹¹ Don't balk yet. This is an *exceedingly* popular view, variants of which we encounter daily. The literature on the ethical treatment of nonperson animals, e.g., is overflowing with evidence that this position is the standard one—although (to be fair) such evidence is also regularly accompanied by lamentations about how eager we are not just to endorse this thesis but to exaggerate and exploit it.

in the vicinity of this horrific death. But after internalizing the lesson of the Museum Curator Story, we might be a bit more cautious. Just as a stunningly beautiful three-dimensional statue may have a horrifically ugly two-dimensional cross-section, so too, a stunningly beautiful four-dimensional (plurality of) object(s) or array of events may have a horrifically natural evil, three-dimensional cross-section. Furthermore, since there may be vastly many different fusions (or different pluralities) all of which overlap (or include) the death of our mammal in the ravine, we leave open the possibility that there are a sufficiently large number of overlapping but distinct objects or pluralities to exemplify the aesthetic value that will serve as a compensating good for this apparently inscrutable evil.

Do I believe that we have any good reason to think that certain evils of our world are always enveloped in such loveliness? No. Do I believe that their being so is probable, given G? No. Do I believe that such a story is metaphysically possible? Yes. Do I believe that anyone can acquire a justified belief that it is metaphysically possible to secure the value in question (or something equivalent in value or better) without permitting the evils in question (or something equivalent in value or worse)? No. Is it very probable that if this were, in fact, a compensating good for the evil of the death of our mammal in the ravine, then we would be aware of it and would identify it as such? No—for, as with the hermit, whether we are alone or in the midst of an uncountable horde of creatures is a question for whose answer we (on our own) can acquire no evidence whatsoever. Should we think that we can establish that we have good reason for thinking that the possible goods we know of are representative of the possible goods there are by appealing to the fact that we have made an extensive and careful search of the territory available to us? No—for, as with the hermit, the territory available to us might be (at least) one dimension less than the total territory there is, and there is no reason to suppose that the goods realizable in n -dimensional space are representative of the goods realizable in $n+1$ -dimensional space.

8

Hyperspace and Christianity

that ye, being rooted and grounded in love, May be able to comprehend with all saints what is the breadth, and length, and depth, and height; And to know the love of Christ.

Ephesians 3: 17–19, KJV

§1 The Aim of these Reflections

Every once in a while one encounters a particularly aggressive brand of atheism that mistakes some amorphous thing called “our modern worldview” for an invulnerable fortress, sets up residence there, and then launches volleys from the apparent safety of its walls against various Christian doctrines and themes. Some of these offensives are sophisticated and challenging, some are not, and some appear to be more sophisticated and challenging than they are.¹ I aim to disarm certain kinds of criticism that I believe fall into this third camp. Here is the central form of the kind of argument I wish to target.

Recipe for the rejection of Christian belief that p

1. Christians believe that p .
2. p is inconsistent with our modern worldview.
3. If a proposition is inconsistent with our modern worldview, then we have justifying reasons to believe that the proposition is false.

¹ Of course, there are particularly aggressive Christians, too, who unreflectively and without a principled game plan cite biblical passages torn from their original context in opposition to this or that well-established scientific view. Such behavior has its own share of unsophisticated and unchallenging illustrations, as well.

4. Hence, we have justifying reasons to believe that Christian belief that p is false.

A note on the premises. Premise (1) is ambiguous: it may be read (i) 'Christians (*qua* Christians) believe that p ' or (ii) 'Christians (as a group) believe that p '. On reading (i) the idea is that belief that p is partially constitutive of being Christian—that one cannot qualify as Christian without it. (For what it's worth, on that interpretation I suspect that there are remarkably few substitutions for ' p ' that generate truths. But I'm not at all interested here in entering the debate on the minimal belief conditions for being Christian, and I shall set this interpretation aside.) On reading (ii) the idea is that whether or not belief that p is partially constitutive of being Christian, p is—as a matter of fact—held by Christians. (Of course, if 'held by Christians' means held by *all* Christians, then once again there will be precious few substitutions for ' p ' that will generate truths, and most of those that do will be mundane and not connected to traditional Christian doctrines, attitudes, and practices in very significant ways. I suspect, however, that 'held by Christians' is better taken to mean that it is held by a sizeable number (if not a majority) of Christians, that it has the force of some recognizable tradition behind it, and that it has clear and direct relations to well-established Christian doctrines, attitudes, and practices.²) Even without settling on the elusive referent of 'our modern worldview' (which has obvious bearing on the appropriateness of classifying the reasons as justifying), premise (3) is very contentious indeed. I would have thought that the disturbingly frequent pieces in *The New York Times* containing some version of the sentence, "Well, it's time to rewrite the textbooks, since after the last half-century of confident but mistaken consensus, the scientists at one of our leading universities have finally discovered the real story about . . .", would have inspired a bit more modesty than I have witnessed when watching premise (3) pressed into service. I do not, however, wish to quarrel with the extension of 'our modern worldview'

² Fortunately, nothing I say here will require verdicts on what is or is not central to Christianity (or even on what the vexed term 'Christianity' means). One can pronounce on clear instances of being rich without first demarcating the line of separation between the rich and the poor. Similarly, one can recognize that the claims of the Virgin Birth and the resurrection of Christ are clear candidates for the kind of proposition I am here discussing, whereas the once common Christian presupposition of the geocentric theory of the heavens is not.

or take issue with what I take to be its cavalier and overworked invocation. Rather, I'll let premise (3) slide and instead direct my critical remarks at a variety of instances of premise (2). Accordingly, one of my two primary aims in this chapter is to undermine a handful of popular representatives of the recipe for the rejection of Christian belief that p that I suspect have been far more influential than they deserve.

My other primary aim in this chapter is to transform at least some of these efforts to discredit certain fashionable anti-Christian arguments into positive reasons for Christians to take the hypothesis of hyperspace seriously. In other words, I will suggest that not only does the Christian have something to say in response to certain accusations of having beliefs inconsistent with our modern worldview, but, depending on the available alternatives, that those responses may also provide reasonable grounds for endorsing the hypothesis of hyperspace by way of inference to the best explanation.

§2 A Brief Remark on Heaven and Hell

A respectable number of Christian theists will tell you that they believe in Heaven, and a respectable (but perhaps somewhat smaller) number will tell you that they also believe in Hell. The primary reason for the difference in number concerns moral problems endangering the hypothesis of Hell that do not have counterparts (or else have less pressing counterparts) to threaten the hypothesis of Heaven.³ I am here interested in a nonmoral issue, however. Consider this brief quiz: are 'Heaven' and 'Hell' referring expressions? If no—stop; you are finished with the quiz. If yes—do they refer? If no—stop; you are finished with the quiz. If yes—what is the ontological category of their referents?

Christians who get to the third question in this quiz are liable to give very different answers, among which you will find (i) special regions (i.e., special places or perhaps special places at particular times); (ii) a plurality of substances and events that occupy special regions; (iii) certain events or states of affairs—namely, the instantiations of certain states of mind; and (iv) certain events or states of affairs—namely, the

³ These problems are at the heart of an intriguing literature well represented by Walls 2002 and 1992 and Kvanvig 1993.

instantiations of certain relations between minds. We are all familiar with the standard image of living out our days poised between Heaven (some sacred and distant place “up there”) and Hell (some dreaded and distant place “down there”), where wonderful and terrible events transpire—whether now or in a day soon to come. We are likewise familiar with the occasional practice of using an expression indiscriminately to refer both to a region and to its occupants, as with the terms ‘the universe’ or ‘the Arctic Circle’. These remarks, then, illustrate options (i) and (ii) above—both of which, we might note, are committed to there being genuine regions that themselves serve as the referents of the expressions or else as the receptacles for the referents of the expressions. Options (iii) and (iv) can appear to circumvent any commitment to the alleged special regions, by contrast. On options (iii) and (iv), the only straightforward commitment is to minds—and to the extent that one is willing to go idealist or dualist about creaturely persons, this carries an additional commitment only to times.

While I take something like option (i) or (ii) to be the traditional notion, it is common to hear option (iii) or (iv) brought in as a replacement conception designed to avoid pesky questions about just *where* these distant and curious regions are to be found, just how many miles they are from New York, and whether the right spaceship might take us on a visit to Heaven or might be launched on a rescue mission to Hell. Instead, the idea is that (for instance) Hell is a state of mind involving a kind of nonspatial separation from God—option (iii)—or (for instance) Heaven is a relation through which some minds enjoy a beatific vision or a mystical union with God—option (iv). And once again, if these persons are disembodied minds, the relevant states and relations may be instantiated now and forevermore without being instantiated at some particular place. Enough introduction; I have first a minor problem, then an observation, and finally a suggestion to explore.

A minor problem: I take human persons to be material objects. There are (I believe) excellent reasons to do so, both on philosophical grounds and also (perhaps surprisingly) on the grounds that such a metaphysics best conforms to the beliefs, attitudes, and practices that I take to be constitutive of Christianity (see, e.g., van Inwagen 1995*a*, Baker 1995, and Merricks 1999). Accordingly, I reject the idealist or dualist strategy above that would avoid all commitment to special places. On the

metaphysics that I think is required by options (iii) and (iv), the straightforward commitment to human minds doubles as a commitment to certain material objects—and to the extent that one endorses the occupancy account of material objects (as I do), this carries an additional commitment to places, as well. Moreover, given the Christian doctrine of the general resurrection and its very heavy emphasis on an embodied afterlife for human persons, whether or not human bodies are absent from the world to come makes little difference to the need for locations for those equipped with glorious and imperishable bodies to be so embodied (see Bynum 1995 and my 2001*a*: ch. 7). Perhaps it is worth noting, however, that even if a commitment to places were to be thus reestablished, the pesky questions above can still be sidestepped, for there is no requirement that the places in question have current mysterious locations, or are removed at some unfathomable distance, or are unfamiliar in any way—just that they be capable of housing bodies that are enjoying certain distinctive states or bodies that are joined in special relations with one another.

An observation: The attractiveness of demoting Heaven and Hell from their traditional conceptions as places to a mere manner of referring to states or relations depends (I suspect) in large part on painting the new conception as an acceptable enough substitute and as a way to avoid the embarrassment that can be elicited when the incredulous atheist asks why we don't converse with the blessed when our hot-air balloons take us into the clouds, why we don't spy any harp-players when jetting from the East to the West coast, and why the Hubble telescope has yet to photograph any pearly gates. Or, more seriously, when she asks just what sort of miraculous transport is supposed to carry the saved on an intergalactic voyage to their new and eternal home. These inquiries can seem especially awkward in a setting where the received opinion is that the large-scale structure of our universe is very well understood and in which we have fairly impressive access to a rather sizeable local chunk of it. No longer are we inclined to think it compelling to say that, for all anyone knows, the kingdom of Heaven sits proudly in the sky just beyond the reach of our perceptual faculties, or that the tormented suffer in Hell somewhere in the depths below our feet. In fact, retreating from such pointed questions has generated a rather deflationary conception of Heaven in contemporary Christianity. It is easy to feel, though, that we have lost sight of something magnificent when our poor and paltry

modern substitute is held up and compared to St Augustine's vision of a realm in which we shall be lovingly reunited with one another clothed in new and glorified bodies, or to the blissful and brilliant kingdom of light championed by medieval scholasticism, or to the Elysian Fields likeness of the Renaissance conception, or to the unbounded opportunities for social interaction and celebration with the saints in the models from the eighteenth and nineteenth centuries.⁴

Yet, despite the discomfiture of it all, participation in the direction-laden talk of Heaven and Hell is very easy to fall into and remarkably well entrenched. The presupposition of location can be found *everywhere*—from speculative angelology and demonology to both Old and New Testaments, to the creeds, to the pulpit, to conversations at the dinner table. Angels fall from, and ministers climb Jacob's ladder to Heaven, the rich man looks at Abraham and Lazarus across the great chasm that separates Paradise from Hell, and The Apostles' Creed reports Christ himself descending into Hell. I do not mean to suggest that these well-known traditions and scriptural passages cannot be glossed without commitment to Heaven and Hell as genuine locations, but I do mean to bring to the reader's mind the first few entries on an impressive list of examples of the common presumption of Heaven and Hell as places.

A suggestion: As I see it, there is no pressing need to capitulate or to attempt to avoid embarrassment by replacing the tradition of regarding Heaven and Hell as genuine locations with confused and apologetic talk of states and relations.⁵ Where are these curious regions to be found, and how many miles are they from New York? Perhaps they are arbitrarily close both to New York and to the spot on which you are currently standing in the directions *ana* and *kata*; compare a two-space of milk-slices and honey-slices that could be hovering just millimeters above Flatland. Why don't we take a spaceship for a blissful vacation in Heaven or on a bold and daring rescue mission to Hell? Perhaps because our modes of transportation are confined to the directions of our three-space prison; whereas we can travel up, down, left, right, forth, and

⁴ For a fascinating look at some of these competing conceptions, and for a lengthy discussion of the conception of Heaven in twentieth-century Christianity, see McDannell and Lang 1988.

⁵ Or, once again, if there is, then it is grounded in moral rather than physical and metaphysical concerns.

back, no spaceship can take us *ana* or *kata*. Why does no astronaut glimpse the host of Heaven when orbiting the Earth, and why does no rig-worker drill into the bowels of Hell when searching for oil? Perhaps because those simply aren't the directions that can take you to those sacred and terrible locations.

One can, of course, happily embrace the deflationary view if it seems best in the end. Significantly, though, the Christian can grant without a fuss the standard pronouncements of our modern worldview regarding the structure and inhabitants of our local corner of the galaxy, and he can even concede that certain traditional locations for Heaven and Hell are thereby forfeit, while still maintaining that Heaven and Hell are real places with genuine inhabitants (without being ridiculously small, unimaginably far away, or invisible realms magically co-located with the perceptible inhabitants of our everyday world). In fact, given the infinite opportunities for diversity in different subregions of hyperspace, even the most extravagant conceptions of the populations, environments, and hierarchies of Heaven and Hell could be back on the table for discussion, without fear of refutation from what our modern worldview has to say about our own little corner of our own three-space prison.

On an autobiographical note, I do not maintain the receptacle view of Heaven and Hell to be absolutely non-negotiable (but I am a bit hesitant about that). For the impressive number that do, I think that this might appear an attractive argument from Christianity to hyperspace. I will say, however, that I think it is pleasantly suggestive and one of a number of intriguing considerations that together begin to construct a case worthy of consideration. Here's another.

§3 A Brief Remark on the Garden of Eden

In the parting paragraph of his beautifully written and absorbing history of the Garden of Eden in myth and tradition, Jean Delumeau writes: "there is no possible way of reconciling, on the one hand, what science tells us about the origin of the human race and, on the other, the earthly paradise of our holy cards and the position given to our first parents by Western theology" (1995: 233). And a little earlier

the tragic theology of Western Christendom can be explained only by an exaggerated view of the beauties of the garden of Eden and the unparalleled advantages that God has granted to our first parents. But our age is now compelled to agree with Teilhard de Chardin that there is 'not the least trace on the horizon, not the smallest scar, to mark the ruins of a golden age or our cutting off from a better world'. (1995: 230)

Delumeau's 'there is no possible way of reconciling' is, of course, too strong, and Chardin's 'not the least trace' may be a correct enough estimation of the absence of revealing remains in our own three-space but could be a bit premature as a final verdict prior to examining horizons *ana* and *kata*. But first some history.

The modern inclination to regard tales of the Garden of Eden (i.e., Paradise, not Heaven) as charming and quaint allegory (and, one might add, to ridicule non-figurative interpretations) has early roots in prominent figures in the history of Christianity. Philo (in the first century), Origen (in the third century), and St Ephrem and St Gregory of Nyssa (both in the fourth century) all advocated a nonliteral interpretation of the story of the garden, its tree of life, its stunning variety of flora and fauna, and its remarkably well-behaved wildlife. Equally prominent early literalists can be found, however, with St Theophilus of Antioch (in the second century), St Irenaeus and St Hippolytus (both in the third century), and Bishop Epiphanius (in the fourth century) all arguing for the claims that Paradise was beneath the Heavens, its garden, trees, and rivers all material created things, and its genuine location eastward in Eden a historical reality.⁶

Throughout much of Christian history, its leading figures have tended toward realist over figurative readings of the garden passages in Genesis. Undoubtedly, much of this consensus can be traced to the qualified endorsement of Augustine and the heavy endorsement of Aquinas, with the bishop of Hippo and the Angelic Doctor both fully acknowledging the spiritual meaning of the story while firmly insisting on the materiality of the tree of life and on the corporeality of the rivers watering a spatially located garden. Notwithstanding such champions,

⁶ For complete references and discussion of these and many more relevant texts, see Delumeau 1995, to which I am also indebted for the historical material in the following few paragraphs.

traditional reasons for finding realism attractive have always been controversial. Nevertheless, they have been compelling to many. The justifications range from applying widely accepted principles about what factual lessons may be appropriately drawn from the different forms of narrative found in Scripture, to arguments to the [then] best explanations of the origin of species, to providing a temporary home for Enoch and Elijah—notable for being taken out of this world prior to their deaths (joined perhaps by the saints and martyrs), to furnishing a way for Christ to keep his promise to the good thief without thereby requiring a doctrine of immediate judgment and resurrection, to make a truth-teller out of Paul and his tale of a third heaven in 2 Corinthians, to reconcile various claims in Revelation with what was already well known about the world's inhabitants and laws, to serving as a place of rest without decay for the bodies of the departed (or at least certain of their parts) to lie in wait for the day of judgment and, hopefully, resurrection.

While running unopposed, as it were, generations of devoted, extravagant proponents of a historical Eden wrote flowery passages on the characteristics of the garden and fought bitter arguments about the spatio-temporal location of Paradise, passages and arguments that frequently contain *considerably* more detail than the available evidence might have warranted.⁷ Despite these intricate and fascinating battles over geography and chronology, a commonly shared presumption among the combatants was that, wherever Eden was located, the sin of our predecessors had rendered it inaccessible to us—its paths now barred by a flaming sword and cherubim charged with making its entrance impassable to all flesh. Interestingly, it was also supposedly protected from non-living trespassers, such as the rising waters of the alleged great flood of Genesis, which supposedly covered the Earth, yet could not destroy the garden on the often invoked grounds that its position was “too high” to be reached. Whether or not one has the slightest sympathy with the flood story, the widespread conviction that the location of the garden was somewhere near but removed from the Earth (in some direction or other which could not be traversed merely by rising from its surface) dovetails nicely with the suggestions that will

⁷ See especially Delumeau 1995: ch. 9 for the history of debate on the timing of the events allegedly transpiring in the garden—down to the hour!

appear below. Of course, agreement on the impassability doctrine would lead to a conviction that a certain kind of resolution to the dispute on location was simply unattainable—with cherubim on patrol, it's not as if the winning theory simply awaited verification by expedition.

Inevitably, however, the wild exuberance of the Middle Ages and the remarkable ingenuity of its realist representatives gave way to a sobering this-worldly orientation in the eighteenth century and to apologetic and more scientifically informed Christians who, feeling the pressure of the worldview of the times, were willing and even eager to retreat to a symbolic reading of the garden of Genesis. Unsurprisingly, a primary catalyst for this turn of mind in the history of Christian thought was buried in the fossil beds and in what they appeared to say about the age of the Earth, the absence of a great deluge, and the origin of species. Nonliteralism has prevailed.

Today any talk of a historical garden is quite likely to be met with a mixture of pity and condescension at best and with open and unreserved hostility at worst. For what it's worth, I suspect that such widespread contempt (which far outstrips the less common contempt for Christianity in general) depends in no small part on conflating a minimal thesis of a historical Garden of Eden—a privileged and sacred place that plays a unique role in the divine plan—with a number of other theses with which it has been historically entwined. Nonetheless, the claim that there was (and perhaps still is) a spatially located paradisiacal garden is radically distinct from the decisively refuted young Earth hypothesis, the seriously dubious tales of a worldwide flood, the unbiblical yet popular tradition that our forebears possessed preternatural gifts, the somewhat more plausible denial of evolutionary theory, and the doctrine of original sin and the Fall.⁸ Moreover, minimal realism about the Garden is likewise separable from the fine details of the biblical narrative that purports to tell of a pair of historical individuals,

⁸ A quick note: I say 'the somewhat more plausible denial of evolutionary theory' not to suggest that I believe that theory to be false, but simply to register that I think it is grossly oversold. The case to be made not for the verdict that it is incorrect but instead for the verdict that it is much less defensible than is commonly reported is really quite impressive. For some initial philosophical contributions to this debate (and to its overlap with the question of the compatibility of evolutionary theory with the hypothesis of intelligent design), see van Inwagen 2003 and 1993.

of the naming of the animals, of an outdoor surgery, of the conversing with a snake, of the eating of forbidden fruit, of a sewing party, and of the expulsion from the Garden for transgressing its laws. Just to be clear, I do separate minimal realism about the Garden from this host of other hypotheses; in particular, I take the Adam and Eve story (in almost all of its details) to be mythical, although insofar as I believe the construction and preservation of that myth to have been conducted under the influence of the Holy Spirit, I take it to have special significance and to touch on topics of significance to all human persons (near and far, past and future). While admiring memorable devices such as talking snakes and luscious yet forbidden fruits, I take the primary function of the myth to be to document the occurrence of a historical event involving our ancestors—namely, their falling away from God and their separating themselves and their descendants from the divine presence by a path we cannot retrace by our own power. Whether this Fall was embodied in some special individual or pair of individuals, whether it was accompanied by a loss of preternatural gifts, whether it marked a sudden change in the biology or genetics of its participants, or in the environment in which they lived and died, or in the laws that governed that environment—are all questions on which I am more or less skeptical.

But whether there was (and perhaps still is) a Garden of Eden—a privileged and sacred *place* that plays a unique (and perhaps ongoing) role in the divine plan—is a question for whose affirmative answer I can work up much more sympathy. There are, of course, many many different ways to speculate (with wild abandon even) about how the hypothesis of hyperspace can make way for the Garden. In fact, it takes very little creative reading of the many centuries of discussion of the characteristics of the Garden (informed by the hypothesis of hyperspace) to generate several satisfying “fits”, especially when viewed against the variety of historical reasons speaking in favor of realism that were introduced above. I leave such entertaining speculations to the interested reader, who might begin by considering, for instance, questions regarding how the salient landmarks of the Garden could be spatially related to uncontested historical locations (e.g., earthly rivers that allegedly have their headwaters in Paradise), how it might be both spatially proximate, yet altogether unenterable without divine or angelic assistance, how the bodies of the dead might be so easily transported

there to await resurrection, and how it might be ringed by fire barring all flesh without the least trace of haze to serve as a smoking gun revealing its presence. Or, to focus on a historically perplexing example, consider a mighty stumbling block for the Renaissance pastime of rediscovering the location of the Garden on Earth: given the assumptions then in play, the Garden must have been *magnificently* large in order to house the stunning variety of beasts and plants and water enough to supply four major rivers (cf. Delumeau 1995: 172–4). In hyperspace, however, a garden can be as big as you please, as close as you want, and furnished in the most extravagant of ways.

Once again, on an autobiographical note, I do not maintain a minimal realism about the Garden to be absolutely non-negotiable. Again, though, for the minority that do, I would think that this might appear an attractive argument from Christianity to hyperspace. But, as before, I will say that I think it is pleasantly suggestive and one of a number of intriguing considerations that together begin to construct a case worthy of consideration. Here's another.

§4 A Brief Remark on Angels and Demons

As a self-professed non-expert, I marvel at the confidence and level of fine detail in the literature on angelology and demonology. To an outsider, this scholarly pursuit—of advancing beyond the meticulously discussed biblical texts (and apocrypha), sifting through the hundreds of redoubtable and uneven authorities found in apocalyptic, kabbalistic, Talmudic, Gnostic, patristic, and Merkabah texts and lore, and properly evaluating the influence of world literature, music, art, and a wealth of diverse and multi-layered rituals on our traditional beliefs and attitudes regarding angels and demons—seems a staggeringly difficult task.⁹ Fortunately, though, I do not have to take sides on just which sources properly identify genuine angels and demons and on just which texts or customs properly reveal their activities. Instead, I will simply take up the far less daunting chore of rehearsing some of the commonly ascribed accomplishments of the angels:

⁹ For an inventory of and an introductory commentary on these sources, as well as for a taste of what they deliver, see Davidson's accessible and entertaining 1971 (especially the introductory essay).

Angels perform a multiplicity of duties and tasks. Preeminently they serve God . . . They also carry out missions from God to man. But many serve man directly as guardians, counselors, guides, judges, interpreters, cooks, comforters, dragomen, matchmakers, and gravediggers. They are responsive to invocations when such invocations are properly formulated and the conditions are propitious. In occult lore angels are conjured up not only to help an invocant strengthen his faith, heal his afflictions, find lost articles, increase his worldly goods, and procure offspring, but also to circumvent and destroy an enemy. There are instances where an angel or troop of angels turned the tide of battle, abated storms, conveyed saints to Heaven, brought down plagues, fed hermits, helped plowmen, converted heathens. An angel multiplied the seed of Hagar, protected Lot, caused the destruction of Sodom, hardened Pharaoh's heart, rescued Daniel from the lions' den and Peter from prison. (G. Davidson 1971: p. xvii)

That's a representative list. For the purposes of the discussion below, let us note that the alleged doings of the demons are similar enough (although unsurprisingly rather less admirable) as to not require separate cataloguing.

One overwhelmingly striking feature of the entries here is the presumption of embodiment and the attribution of causal control over many of the familiar material objects in our everyday world. Hence the challenge: *if* these marvelous entities are really gallivanting about impregnating women, wrestling men, and conveying various messages to frightened young girls—or (better yet) *if* they are paired up with us one-one, vigilantly hovering ever so near, guarding their charges, and watching our every move . . . then why don't the majority of us see and hear them? At least once in a while? Presumably even the most radiant and beautifully embodied things have definite shapes and locations. Just where is this vast horde of do-gooders camped? How do they travel to their appointed destinations with such apparently lawbreaking speed and ease? With all that heavy lifting to do, how on earth do they continually manage to avoid reflecting light or making noises that would expose their hiding places?

As you no doubt anticipate from the preceding two sections, answers to these pointed questions are available from the plentiful resources of hyperspace. There are, of course, serious and troubling worries (both moral and metaphysical) about the existence and status of angels and demons that are worth confronting. There are, of course, serious and

troubling questions about the authority (or lack thereof) of texts and traditions reporting their whereabouts and assignments that are also worth confronting. There are, of course, the impatient and contemptuous stares that the mere mention of angels and demons provokes in many educated folk in the twenty-first century. Still, these controversies need not, perhaps, be fueled by worries about literal locations or apparent hiddenness. Angels and demons, should they exist, can be embodied with perfectly determinate shapes and sizes, and they can be endowed with familiar causal powers to manipulate the material objects in our everyday environments, and they can be thoroughly subject to detection even by perceptual faculties as crude and insensitive as ours. Yet they can accomplish their merciful or awesome or sinister feats (as the case may be) while avoiding exposure—simply by carefully exploiting the opportunities afforded by movement in hyperspace.

One final time then, on an autobiographical note, I do not maintain this multi-dimensional route of escape from the pressing questions on the location and mysterious hiddenness of angels and demons to be absolutely non-negotiable. However, I do think that this might ground an argument from Christianity to hyperspace attractive to the sizeable group of Christians who profess belief in angels, demons, and their interactions with each other, the world, and ourselves. But, as before, I say that I think it is pleasantly suggestive and one of a number of intriguing considerations that together begin to construct a case worthy of consideration.

§5 New Testament Miracles

The four gospels of the New Testament tell a series of powerful and moving stories. Belief in the literal occurrence of many of the events relayed in these narratives is often taken to be partly constitutive of being Christian and to be at the very core of Christianity. I have neither the expertise nor the confidence to comment with much authority or at any great length on the passages and traditions which make an appearance below. (In fact, it takes only a brief trip to a modestly equipped library to teach the novice how frightfully much there is to learn on these topics and to replace any rash intention of making confident pronouncements with the less ambitious hope of advancing tentative

hypotheses.) Nevertheless, I have selected three significant moments from the gospels that I would like to discuss in the hopes of paying off a promissory note offered in section 1 above.

As mentioned earlier, I'm not at all interested in entering the debate on the minimal belief conditions for being Christian, but I do think that the case to be made for the centrality to Christianity of the alleged events discussed below is considerably stronger than is, say, the case for a historical Garden of Eden. Consequently, I suspect that a respectably large number of Christians take a straightforwardly literal line on the reporting of these alleged events. But this widespread literalism is precisely the source of a number of deeply influential instances of the recipe for rejection of Christian belief that *p* (i.e., of instances of the argument form that was the subject of a brief introduction in section 1 above). Since every one of the alleged events in question is frequently criticized as being at irreconcilable odds with our modern worldview, these beliefs are exactly the sort of target that certain fashionable arguments are so often thought to strike with lethal force. Once again, however, it seems to me that not only does the Christian have a way to block the charge of inconsistency with our modern worldview, but also that the very same responses that restore consistency may (depending on the available alternatives) provide reasonable grounds for endorsing the hypothesis of hyperspace by way of inference to the best explanation.

The Virgin Birth

The virgin birth of Jesus Christ is a view very widely endorsed by the councils and creeds and the early church fathers. There are, of course, a variety of interpretations of this traditional view. Perhaps the weakest of these takes as its point of departure the Annunciation (in Luke 1: 26–8), in which Mary acknowledges her virginity to the angel Gabriel, but the account does not take a stand on her virginity beyond the beginning of her pregnancy. At the other end of the spectrum, perhaps the strongest of the interpretations maintains that Mary remained a virgin throughout her life. One central point of agreement, however, is that whereas Mary played a biological role (and a voluntary role) in bringing Jesus into the world (e.g., in supplying biological material for the body of Jesus and nutrition during his stages of prenatal development), tradition

declares that Jesus was conceived by the Holy Spirit (as opposed to any human father). These details suffice as background for the objection.

The objection: no one can become pregnant in this fashion, and talk of such a supernatural origin is nothing more than a transparent thievery from pagan mythology. Every child knows that you can't put an object in a closed box without opening its lid or penetrating one of its surfaces, and Christians are in some serious trouble if their only way to explain Mary's pregnancy without threatening her virginity is to maintain that objects suddenly appear out of thin air in her womb or else pass into (and out of) her body without disrupting the integrity of its natural barriers.

A response: first, a quibble. Even if our modern worldview generally frowns upon fanciful tales of material things popping into existence out of thin air and of objects mysteriously moving through walls without disrupting the integrity of their surfaces, it is perhaps an exaggeration to insist that it is *inconsistent* with these events. Indeed, popular presentations of theoretical physics routinely make a grand show of announcing how surprising today's fashionable theories have (at long last) discovered the material world to be, and talk of discontinuous jumps or of objects doing something very much like materializing out of thin air serve as centerpieces in these explanations. But set that aside.

Consider a closed box in Flatland (it's just a square with an unbroken perimeter and an empty interior). You can't put a Flatland object in the box without opening its lid or penetrating one of its surfaces—unless, that is, you don't confine your movements to the two-dimensional space in which the square is found. With access to three dimensions, it's an easy matter to astonish the simple folk of Flatland by taking an object up, then moving it above the interior of the square, and finally moving it back down so that it rests safely in the square's interior. When the scientists of Flatland inspect the perimeter, they will find that the square's natural barriers are undisturbed and that the lid has remained locked throughout the process. There are, of course, other hypotheses available to the denizens of Flatland. Perhaps the object passes through the surface of the square without doing violence to it in the manner of two material objects that can co-locate without sharing parts and without causally affecting one another in the process. Or perhaps the object underwent a discontinuous jump of location. The relevant point is not that a movement through three-space is the only available way to

generate the outcome, but rather, that it is one available way that doesn't require the inhabitants of Flatland to take a stand on the physics of discontinuous motion or on the metaphysics of co-location or on anything at all bound up with their modern worldview.

Similarly, then, with access to four dimensions, even if the Holy Spirit (like Mary) had to make a material contribution to the conception of Jesus, it is an easy matter to take the relevant material object *ana*, then move it over the interior of Mary's womb, and finally move it back *kata* so that it rests safely in the womb's interior, without disturbing any natural barriers in the process. Once again, however, perhaps the conception of Jesus by the Holy Spirit required only the presence of material in Mary's womb (or certain changes in material already there) which did not have an empirical causal history extending outside her body. Or perhaps some material object was the subject of divinely directed discontinuous motion from outside to inside Mary's body. Or perhaps material penetrated Mary's body without loss of integrity to its surfaces by way of co-location. As before, though, the point is not that a movement through four-space is the only available way to generate the outcome, but rather that it is one available way not subject to immediate refutation by appeal to our modern worldview.

Three miracles of Jesus: water into wine, the feeding of the 5,000, walking on water

The gospels tell of a number of miracles allegedly performed by Jesus. Several of these alleged miracles have come under heavy fire, and those that profess them under heavy ridicule. I would like to develop some thoughts concerning New Testament miracles by focusing on three that often provoke especially harsh responses: (i) changing water into wine at the wedding at Cana (John 2: 1–11) (ii) the feeding the 5,000 with five loaves and two fishes (Matt. 14: 13–21; Mark 6: 32–44; Luke 9: 10–17; John 6: 1–14) and (iii) walking on water in the Sea of Galilee (Matt. 14: 22–33; Mark 6: 45–52; John 6: 15–21). The stories are so familiar that they need no retelling, as is also the case with regard to the most common objections confronting them. How, then, can the hypothesis of hyperspace be of service here?

With respect to the miracle of changing water into wine, allegedly, although the stone jars were filled with water, they poured wine. So

where did the water go? Here are some rather intriguing hypotheses. First option: the water went nowhere at all, for a single substance was inside the jars throughout, which was first water and then wine. This option has its share of physical difficulties (e.g., the unpromising view that being water is a phase-form of a kind of stuff which has among its other potential phase-forms being wine). Second option: the water went nowhere at all, for whereas the water remained, the right ingredients were added to and properly mixed with the water already present to produce wine when poured. This option has its share of physical difficulties as well (even though one tradition of commentary of Jesus as magician speculates on the chemicals allegedly residing in the bottom of the jars which would return any gift of water with something approximating a rather poor-quality wine). Third option: the water stayed right where it was (i.e., confined to the partitions of the jar containing only water), and then the jars were emptied of wine (which was carefully hidden away in the other partitions of the jar all along). This would surely be an amusing party trick, but one supposes rather easily exposed and (given the circumstances of the wedding) rather hard to set the stage for at the outset. Fourth option: the water disappeared from the jars entirely, and was very quickly replaced with wine, which completely filled the cavity thereby vacated. Of course, the natural response to the fourth option is that it offends against our modern worldview; more than a hundred gallons of water doesn't up and vanish from six stone jars so quickly (or at least not without them getting smashed and other things getting noticeably wet), and despite how nice it would be if it were otherwise, wine doesn't cooperatively appear and fill our empty containers from the inside out. Moreover, this natural response is a perfectly sensible response. Suppose, however, that the water is displaced *ana*, and that the wine is poured into the jars from wineskins lying *kata*. Then, although nothing in our own three-space gets wet, a hundred gallons or more may well be bathing some garden just inches away, and although no visible container empties its contents into the waiting jars, wineskins arbitrarily close to the cavities of the jars fill them to the brim without ever leaving their own locations outside our three-space. And all this transpires with no dry chemicals hidden within, or multiple partitions secreted away in, the jars.

With respect to the feeding of the 5,000, allegedly five loaves and two fishes fed a multitude (with several basketfuls left over). Where did the

food come from? Well, presumably the pattern is becoming clear. Without magic or creation *ex nihilo*, a nearly empty basket can come to contain a previously undetected fish (which travels ana into the basket) and loaf (which travels kata into the basket). And provided that the nearby spaces are well stocked, the basket can prove hard to empty should it acquire its contents in this fashion.

With respect to Jesus' walking on water on the Sea of Galilee, allegedly Jesus walked on water over a considerable distance to reach his disciples, who were rowing a boat in the middle of the Sea in the middle of a storm in the middle of the night.

Objection: No he didn't.

A response: Let your thoughts drift once again to Flatland. Suppose that the polygons residing there are bound by something like gravity to the perimeters of enormous circles—their planets, so to speak. To pass one another, they have to either jump over or tunnel under one another. Moreover, the interior of these circles is occupied by analogues of soil and water (i.e., a kind of substance on which they can rest and move and another kind of substance in which they will sink towards the center-point of the circle and perish). Now one of these planets has the following feature: Flatland soil is found on all points of its perimeter with the exception of a small arc which features Flatland water (i.e., if the circle were a clock, only the region from 12:00 to 1:00 would be Flatland water, while the remainder would be Flatland soil). Any polygon wanting to travel from the point located at 11:59 to the point located at 1:01 either has a long journey ahead of him or else had better build a bridge. Bridges aren't impossible here. Dig up a skinny curved rock in the Flatland soil, keep it in front of you, stand it upright, let it fall across the Flatland water, and then scamper across to the other side. Of course, a proper bridge like that has to come from somewhere, has to have enough length to span the relevant gap, and has to be locatable by the Flatlanders on the other side of the arc awaiting your arrival, since it is extended in the space in which they reside. Finally, suppose that there just don't happen to be any rocks on this planet large enough to do the trick. Not all is lost, however, for with the assistance of a good-natured three-spacer a perfectly good bridge can be had; this benefactor need only take some two-dimensional object out of Flatland, turn it sideways, and reinsert it so that it extends above and below Flatland at right angles. The agreeable object will, of course, still

intersect Flatland, but with only one of its one-dimensional cross-sections. Provided this cross-section is more like Flatland soil than Flatland water, that's all you need to bridge the gap. Curiously enough, even if the resulting bridge were merely a proper part of a much larger object, it might nevertheless be very hard for the Flatlanders on the other side of the gap to detect it, since (after all) it intersects the space in which they reside only on a curve. In fact, it would be natural enough to believe that a Flatlander approaching on this bridge was walking on Flatland water.

The relevant application should be straightforward enough. Take some well-chosen three-dimensional object (either from somewhere in our own three-space or from some neighboring three-space), turn it sideways (so to speak), reinsert it so that it intersects our three-space with only one of its two-dimensional cross-sections, position that cross-section so that it spans the Sea of Galilee, and then (provided that the cross-section is more like soil than water) permit a three-spacer to walk across the bridge. Finally, when the structure has served its purpose, simply withdraw the original object and restore it to its original location—no remnants of the temporary bridge need remain. Curiously enough, even if this bridge is merely a proper part of even a monstrously big object, it may nevertheless be very hard for the three-spacers in the middle of the Sea in the middle of a storm in the middle of the night to detect it, since (after all) it intersects the space in which they reside only on a plane. In fact, it would be natural enough to believe that anyone traversing this bridge was walking on water.¹⁰

Intriguingly, several of the other allegedly physically impossible events recorded in the New Testament are susceptible to similar candidate explanations that take some detour or other through hyperspace. Perhaps the discussion initiated here can serve as a model for the

¹⁰ So why does Peter sink when he ventures out of the boat? It should be obvious that there is a variety of ways to respond (and that for present purposes it really doesn't matter which addition we tack on to the story). The only point being advanced here is that the perfectly reasonable thoughts backing the brief but apparently compelling objection reported above (e.g., that no man can stand unsupported on a surface of only water, that it is contrary to our understanding of the world that temporary bridges extending for miles can materialize and dematerialize without a trace, that the relative strengths of the fundamental forces don't go locally suspended from time to time, and so forth) need not be forfeited in order to provide a "just so" story that reconciles an allegedly offending report with the restrictions imposed by our modern worldview.

interested reader to explore the extent to which many of the miracles attributed to Jesus can be defended when subjected to the all too familiar kinds of critique rehearsed above.

The resurrection of Jesus and the ascension

One of the most central claims in all Christianity is that, after his suffering, death, and entombment, Jesus Christ rose from the dead and appeared to friends and disciples a number of times before his ascension (Matt. 28; Mark 16; Luke 24; John 20). So central is this that a surprising number of Christians seem willing to let the entire case for their faith rest upon this one foundation.

Philosophical, scientific, and religious questions, objections, and replies concerning the possibility and mechanics of the resurrection of Jesus, its relation to the doctrine of the general resurrection, and its alleged role in our salvation and redemption are legion. Here, however, I am concerned with only a rather small corner of that complex debate.

One might suppose (as I do) that Jesus was embodied throughout the period between his death and ascension.¹¹ Or one might suppose (as, I suspect, do most of those who are sympathetic to the doctrine at all) that Jesus was separated from his body at death and later reunited with his body before appearing to the women and his disciples. In either case, the body which is Jesus' body (either by identity or in virtue of its past- and future-oriented properties) was somewhere or other throughout the period between his death and ascension.¹² Or, if his body was not somewhere or other, then at least the parts that composed it at its death were still in relative proximity to one another, and those "particles arranged corpse-wise" were jointly somewhere or other throughout the period between his death and ascension.¹³ Although the view that Jesus

¹¹ My thoughts on the doctrine of the general resurrection and on the nature of human persons (drawn primarily from my 2001a: ch. 7) lead me to think this is the best option.

¹² A quick acknowledgment: those who opt for the claim that Jesus (like other human persons) is identical to a material object have some explaining to do. One option is that being human is a phase sortal of certain persons who are embodied throughout their existence. Another option is that being material is not an essential property of those objects that exemplify it; in other words, one of the changes that certain things can survive is from material to non-material thing.

¹³ This last bit to leave open the restricted metaphysics of composition endorsed by van Inwagen 1990b, Merricks 2001, and Olson 1997. For more on this topic see my 2006.

acquired a numerically distinct body at his resurrection may seem to receive some support from the Lucan account (24: 13–31), in which a risen Jesus walked with those who had known him without being recognized, this view seems wholly undercut by the claims that the resurrected body bore the wounds of the crucifixion and by the tradition of commentary on both the resurrection of Jesus and the general resurrection.

So a puzzling question presents itself to anyone who professes belief in the resurrection of Christ: exactly where was the body of Jesus during the supposed forty-day interval between his rising from the sepulcher and his ascension into Heaven witnessed by his disciples? Unsurprisingly, the question can quickly get even more puzzling, depending on one's further commitments, which may lead one to countenance even further restrictions on an acceptable answer. For example, one might note that the strips of linen and the burial cloth that John 20: 3–9 describes as remaining on the floor of the tomb mean that the body had simply disappeared from its clothing as well as its tomb (as a way of arguing against the hypothesis that the body was stolen from its resting place by thieves, who presumably wouldn't have taken the time to disrobe it first). Or one might focus on a popular tradition found throughout Scripture and in The Apostles' Creed—that between his death and resurrection Jesus descended into Hell (interpreted as a genuine bodily change of location which permitted Jesus to preach the message of redemption to some of the departed, as opposed to an interpretation merely emphasizing his hellish agony and suffering on the cross). Or one might take the description of Luke 24: 31 at its word and maintain that the body of the risen Jesus could suddenly vanish from the sight of those seated at table with him. Or one might insist on the literalness of John 20: 19 (and again of John 20: 26) in which a risen Jesus abruptly appears in the midst of his disciples gathered together in a locked room without, the gospel writer intimates, entering through either a window or a door.

Understandably, to the extent that the gospel accounts of the resurrection are committed not only to the view that someone has risen from the dead, but also to the view that the risen man can apparently appear and disappear at will, they will have a tough time earning the respect of (or even a patient hearing from) those students of the modern world-view who have learned that medium-sized objects like human bodies

simply don't behave like that. As before, though, the hypothesis of hyperspace can offer some protection from at least one form of criticism on this score.

To return one final time to the general theme of this chapter, then, let us acknowledge that a body moving *ana* or *kata* could leave its clothes or burial robes without taking them off, could vanish from a dinner table without a trace, and could appear in a locked room without passing through its windows, doors, or walls. In short, a body free to move in hyperspace could be positioned just inches away, yet remain undetectable for days on end, and could enter and leave our own three-space with exactly the ease and abruptness that is attributed to the risen Jesus.

A parting (tentative) comment: in the description of the ascension which opens the book of Acts (1: 1–11), the disciples who have just seen Jesus disappear for the last time are informed that “this same Jesus, who has been taken from you into heaven, will come back in the same way you have seen him go into heaven”. Accordingly, one who is already committed to the relevant New Testament claims and who finds the discussion in this chapter promising, not only as a defensive maneuver to combat one popular style of criticism, but also as a candidate for the best explanation of a phenomenon he or she thinks requires explanation, should not be at all surprised if (like the next revolution in physics) the Second Coming turns out to take a path through higher-dimensional geometry.

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