Theories of Persistence

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Declaration

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree.

I certify that to the best of my knowledge any help received in preparing this thesis, and all sources used, have been acknowledged.

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Abstract

This thesis is a survey of metaphysical theories of persistence through time. For each of the theories considered, I concisely state the theory, describe the positive arguments in its favour, suggest ways in which that theory could reply to positive arguments for other theories, discuss some outstanding problems for that theory as stated, and describe some variants on it. In the course of this, I stake out my own distinctive view about persistence, which is a version of endurantism.

I also argue for some preliminary results that are needed for the discussion of persistence. These involve issues in metaphysics that I regard as foundational with regard to the debates over persistence: intrinsic properties and the part-whole relation. I take the views: that the distinction between intrinsic and extrinsic properties is orthogonal to that between non-relational and relational properties; that, strictly speaking, properties are neither relational nor non-relational; and that intrinsicality is unanalysable. In discussing part-whole, I defend a certain attitude to mereology, which I call "mereological realism"; and assuming mereological realism, I defend the controversial features of classical mereology.

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Epigram

"Master," I said to him, "I understand nothing."

"About what, Adso?"

"First about the differences among heretical groups. But I'll ask you about that later. Now I am tormented by the problem of difference itself. When you were speaking with Ubertino, I had the impression you were trying to prove to him that all are the same, saints and heretics. But then, speaking with the abbot, you were doing your best to explain to him the different between one heretic and another, and between the heretical and the orthodox."

...

"When I say to Ubertino that human nature itself, in the complexity of its operations, governs both the love of good and the love of evil, I am trying to convince Ubertino of the identity of human nature. When I say to the abbot, however, that there is a difference between a Catharist and a Waldensian, I am insisting on the variety of their accidents. And I insist on it because a Waldensian may be burned after the accidents of a Catharist have been attributed to him, and vice versa. And when you burn a man you burn his individual substance and reduce to nothing that which was a concrete act of existing, hence in itself good, at least in the eyes of God, who kept him in existence. Does this seem a good reason for insisting on the differences?"

"The trouble is," I said, " I can no longer distinguish the accidental difference among Waldensians, Catharists, the poor of Lyons, the Umiliati, the Beghards, Joachimites, Patarines, Apostles, Poor Lombardists, Arnoldists, Williamites, Followers of the Free Spirit, and Luciferines. What am I to do?"

— Umberto Eco, *The Name of the Rose*, (Eco 1984, pp. 196–197)

Part I

Preliminaries

Chapter 1

Introduction

This thesis is a survey of metaphysical theories of persistence through time. For each of the theories I consider, I concisely state the theory, I describe the positive arguments in its favour, suggest ways in which that theory could reply to positive arguments for other theories, discuss some outstanding problems for that theory as stated, and describe some variants on it. This all takes place in part II. Part I discusses some preliminary material.

Some of the issues discussed in this thesis receive more detailed treatment in the freestanding papers included as appendices. I will refer to these as appropriate.

1.1 Outline of Parts I and II

In part I, I argue for some preliminary results that are needed for the arguments of part II. These involve issues in metaphysics that I regard as foundational with regard to the debates over persistence: intrinsic properties (discussed in chapter 2) and the part-whole relation (discussed in chapter 3).

Chapter 2: Intrinsic properties

The first section of this chapter simply describes what I take to be those features of intrinsicality which should be independent of any attempt to give a theory of properties or an analysis of intrinsicality. In it, I describe the important concept of intrinsicality that plays a large role in the arguments

of chapters 4 and 5. I argue for a distinction among extrinsic properties
between, as I put it, 'mongrel' properties versus 'extrinsic*' properties (sec-
tion 2.1.2); that the distinction between intrinsic and extrinsic properties is
orthogonal to that between non-relational, and relational properties; that,
strictly speaking, properties are neither relational nor non-relational (section
2.1.6); and that it is possible to classify impure, or "haecceitistic" proper-
ties with regards to intrinsicality (section 2.1.7). I also suggest a connection
between truthmakers and intrinsicality (section 2.1.3) which is argued for in
more detail in appendices A and B.

The second section deals with attempts to analyse intrinsic. I offer an argu-
ment that no analysis is possible in purely modal terms (section 2.2.1); and
discuss a counterexample to an analysis in terms of modality and naturalness
(section 2.2.2). This counterexample was first described in a paper by myself
and Dan Marshall, which is reproduced as appendix D. Finally, I conclude
that it is not problematic to regard intrinsic as unanalysable (section 2.2.3).

Chapter 3: Parts and wholes

The purpose of this chapter is to set out the type of mereology, or metaphys-
ical theory of the part-whole relation, that I will be relying on in arguments
in later chapters. This is the so-called "classical" mereology of Goodman and
Leonard, described in section 3.1.

I also defend a certain attitude to mereology, which I call "mereological real-
ism" (section 3.2). Assuming mereological realism, I defend the controversial
features of classical mereology (section 3.3). I discuss an alternative way of
defending classical mereology, which I do not think works (section 3.4).

Finally, I discuss some mereological and quasi-mereological proposals con-
cerning atomism that are left undecided by classical mereology (section 3.5).
Among these is the doctrine of arbitrary undetached parts, or DAUP. I reject
DAUP, but not for the usual reasons, which turn on a rejection of classi-
cal mereology. In fact DAUP is independent of classical mereology (section
3.5.3).

Part II: Theories of Persistence

In this part I discuss three theories of persistence. Each theory has its own
chapter, and the chapters all have a similar structure: they are broken into

the following sections:

- **The Theory**: contains a concise statement of the theory under discussion in each chapter.

- **Arguments**: contains positive arguments for that theory.

- **Problems**: contains problems specific to the theory under consideration.

- **Replies**: contains replies to the positive arguments of previous chapters; or to problems from previous chapters.

- **Variants**: contains discussion of variants on the theory under consideration; often these will be motivated by the need to reply to arguments considered under "Problems".

Chapter 4: Perdurantism

This chapter discusses perdurantism, or the temporal parts theory of persistence. There are three main types of argument for it: arguments from an analogy between space and time — particularly between extension in space, and persistence through time (section 4.2.1); arguments concerning the possibility of intrinsic change (section 4.2.2); and an argument from the possibility of a scenario very like perdurance — the sucessive creation and annihilation argument (section 4.2.3).

I consider three problems for perdurantism. The first is not really a problem, but more of a clarification — perdurantism is often confused with another theory of persistence that is really more closely related to presentism (section 4.3.1). This theory itself is discussed later, in section 6.5.2. The second is a problem about the strange scattered objects that a perdurantist who also accepts classical mereology is committed to (section 4.3.2). The third problem is the 'problem of the many' — the problem that the perdurantist seems committed to many more ordinary objects than we ordinarily take there to be (section 4.3.3).

I describe two variants on perdurantism. The first are those theories that consider perduring to be a necessary, but not sufficient condition of persisting, which I call "strong perdurantism" (section 4.4.1). The second concerns the issue of whether a perdurantist should believe that there are instantaneous temporal parts (section 4.4.2).

Chapter 5: Endurantism

This chapter discusses endurantism, or the multiple location theory of persistence.

The positive arguments for endurantism are mostly reactive — they argue against perdurantism by claiming that perduring objects cannot change (section 5.3.1); or that, if it is possible to defuse the positive arguments for perdurantism, endurantism appears to be a reasonable generalisation of perdurantism (section 5.3.2).

Both these arguments require that those positive arguments for perdurantism that appear to rule out the possibility of endurance be answered, and I survey attempts to do that in section 5.2. I consider two replies to the argument from analogy: one which denies the analogy between space and time (section 5.2.1), and one which denies that objects always extend through space in a manner analogous to perdurance (section 5.2.2). I consider three replies to the problem of change: a reply that involves indexing properties to times (section 5.2.3); my own version of this reply, which draws on my earlier comments about intrinsic properties in chapter 2 to show that the indexed properties may be intrinsic (section 5.2.4) — this solution to the problem of change is discussed in more detail in appendix C; and a reply that involves 'adverbial modification' (section 5.2.5).

I discuss one outstanding problem for endurantism, to do with temporary parts (section 5.4.1); and a variant on endurantism that claims that some objects endure while others perdure (section 5.5.1).

Chapter 6: Presentism

This chapter discusses presentism, a metaphysical theory of time of which the most important part is the doctrine that there is only that which exists now — there is no past or future. Presentism also involves distinctive claims about tensed language (section 6.1.1) and about persistence (section 6.1.3).

The main argument for presentism that is independent of its treatment of puzzles concerning persistence consists of a series of analogies that presentists draw between time and modality (section 6.3.1), and between aspects of the language of time, and modal language (sections 6.3.2–6.3.3). Another part of the appeal of presentism is the simple answers it can give to the problems

raised by arguments for perdurantism: the analogy with space (section 6.2.1) and the problem of change (section 6.2.2).

But presentism has its own problems in reconstructing ordinary truths about the past and future. I consider these in section 6.4. Among them is a problem concerning truthmakers for past and future tense truths (section 6.4.4) which draws on my earlier comments about truthmakers in chapter 2, and in appendices A and B

Finally, I argue that the presentist theory of persistence is really independent of the other parts of presentism by considering two variants on presentism. The first combines the presentist's doctrines about the unreality of the past and future with endurantism (section 6.5.1); the second combines the presentist theory of persistence with realism about the past and future, and a temporal parts ontology (section 6.5.2).

1.2   Textual Conventions

Displayed propositions are given unique boldfaced numbers, like this:

> **1** This is a displayed proposition.

Sometimes a displayed proposition may be given a name instead, like this:

Def$_<$ $x < y =_{df} (\forall z)(z \circ x \supset z \circ y)$

Where I wish to enumerate a list for other purposes, I use circled numbers, like this:

> $<$ Just one thing,
>
> $>$ and then another.

These circled numbers are not unique, and will not be referred to in the text.

Citations are given in author-date format, like this: (Armstrong 1968). Full details for each cited work may be found in the bibliography.

I hope my usage of logical symbolism will be self-explanatory. The only points were it might not be is in chapter 3, where additional symbolism is introduced for formal mereological systems (this is explained in section 3.1), and in chapter 6, where **P** and **F** are used as sentential tense operators. These operators are always rendered in boldface to prevent confusion with predicate symbols.

I use greek letters ϕ, ψ,... as schematic variables ranging over predicates. When naming properties, I sometimes abbreviate "the property of being ϕ" to "*being ϕ*", where the latter are always rendered in italics.

Double inverted commas (""), I use for mention and quotation; single inverted commas (') I use for nested quotation, and 'scare quotes'.

I use boldface to highlight technical terms and neologisms at the point that they are defined. Page references for these points can be found in the index.

Chapter 2

Intrinsic Properties

2.1 Concepts of Intrinsicality

Several of the arguments connected with perdurantism, especially the problem of change (see section 4.2.2) involve the notion of an intrinsic property. Intuitively, a property is **intrinsic** if whether an object has it is dependent on how that object is, and not on how the object's surroundings are. An **extrinsic** property is one that is not intrinsic. Examples of intrinsic properties of those of being 6 feet tall and being made of stone. The properties of being 10 km away from Canberra and being next to a tree are, on the other hand, extrinsic.

It is extremely difficult to cash out this intuitive characterisation in a way that does not seem circular. To see why, notice that "how an object is" in the intuitive characterisation of intrinsic has to be understood as "how an object is, intrinsically". Being next to a tree is a way that someone is, and, of course, whether someone has the extrinsic property *being next to a tree* is dependent on whether they are that way. The intuitive characterisation, then, does not suffice to distinguish, among say, sets of possible individuals, as to which correspond to intrinsic properties, and which do not. It does however seem to suffice to teach philosophically unsophisticated persons the meaning of the term "intrinsic" and to enable them to make the usual judgements about the example properties given in the previous paragraph.

There are a number of important concepts that I will refer to from time to time that are related to intrinsic/extrinsic. In this section, I'll briefly discuss them. In section 2.2 I discuss some attempts to analyse "intrinsic" in terms

of other concepts.

2.1.1   Local intrinsicality

It is normally repeatable properties that are said to be intrinsic or extrinsic. However, people sometimes use the terms as verbs or adverbs, for example: "This lump of lead is intrinsically massive" or "The property of being such that someone is snub-nosed is intrinsic to Socrates, but extrinsic to Plato — Plato *is* such that someone is snub-nosed, but only extrinsically."

When "intrinsic" is used in this way, we are talking about **local intrinsicality**. By comparison when we say "mass is an intrinsic property" or "being such that someone is snubnosed is an extrinsic property", we are talking about **global intrinsicality**. (HUMBERSTONE 1996)

We can also speak of an object's failing to have a property intrinsically. Plato extrinsically fails to have the property *being such that noone is snub-nosed*, while Socrates intrinsically fails to have it.

For the sake of generality, I will say that a property ϕ is intrinsic to an object x iff either x intrinsically has ϕ, or x intrinsically fails to have ϕ. Similarly, ϕ is extrinsic to x iff either x extrinsically has ϕ, or x extrinsically fails to have ϕ. Note that in this usage, it does not follow from the fact that a property is intrinsic to an object that that object has that property.

The local and global concepts of intrinsic are connected by the fact that the (global) intrinsic properties are all and only those that are (local) intrinsic to all possible objects. The analogous definition, however, does not hold for extrinsic — some extrinsic properties (like *being such that someone is snubnosed*) are intrinsic to some objects, and extrinsic to others. So, the (global) extrinsic properties are all and only those that are (local) extrinsic to *some* possible object.

2.1.2   Intrinsic* and extrinsic* properties

What about the properties that are extrinsic to *all* possible objects? These are an elite group among the extrinsic properties, which I call the **extrinsic*** properties. A property is **intrinsic*** if it is not extrinsic*. The intrinsic* properties are also all and only those that are intrinsic to some possible object.

Intuitively, extrinsic* properties are those that depend just on how the object that has them's surroundings are, and not on how that object itself is.

Examples of extrinsic* properties include properties of the form of *being an x such that something wholly distinct from x is snub-nosed* and *being 10 km from a capital city*. The former of these two properties is often described (following (LEWIS 1983A)) as *being **accompanied by** something snub-nosed*, a usage that I will follow.

The set of intrinsic* properties include both properties that are intrinsic, and properties that are extrinsic (just as the set of extrinsic properties include both extrinsic* and intrinsic* properties). This may be made clearer by figure 2.1, which shows three properties: an intrinsic property, an extrinsic* property and a property that is extrinsic without being extrinsic*, together with the categories into which they fall.

intrinsic - *being 1 kg in mass*

extrinsic { *being such that something is 1 kg* } **intrinsic***

being accompanied by something 1 kg **- extrinsic***

Figure 2.1: Comparison between intrinsicality and intrinsicality*

The category of intrinsic* is not a very useful one — it seems odd to group together properties that are intrinsic and those that are intrinsic to some instances and not others. But the distinction between extrinsic* properties and merely extrinsic properties shows up an important piece of conceptual space that is missing from the straightforward global intrinsic/extrinsic distinction.

Really we should think of the global intrinsic/extrinsic distinction as a three way distinction, between intrinsic properties, extrinsic* properties, and those properties that, intuitively speaking, can be realised in an intrinsic way, as well as in an extrinsic way. These last properties, which are extrinsic, but not extrinsic*, I call **mongrel** properties. This three-way distinction is displayed in figure 2.2.

intrinsic - *being 1 kg in mass*
mongrel - *being such that something is 1 kg in mass*
extrinsic* - *being accompanied by something 1 kg in mass*

Figure 2.2: Three-way global intrinsicality

It is tempting to say that the mongrel properties are all disjunctive properties, disjoining some intrinsic property with some extrinsic* property. However, to say this would be to beg some important questions in the theory of properties, as it is not clear whether it is possible to distinguish between disjunctive and non-disjunctive properties in advance of a substantive ontological theories of properties (see appendix D for more on this point).

Being a cube and accompanied by a cube is a difficult example. You might think that this is extrinsic* because it can only be had extrinsically. It can however, be lacked intrinsically — cubes intrinsically fail to have this property, and so it is a mongrel. Since this is an intuitively conjunctive mongrel, it is also a counterexample to the conjecture of the previous paragraph.[1]

2.1.3   Truthmaking

For any proposition, p, there is a property of *being such that p is the case*. If there is anything to which has that property intrinsically, I say that that thing makes p true (see appendices A and B). So, for example the proposition *that Socrates is snub-nosed* is made true by Socrates and not by Plato, because *being such that Socrates is snub-nosed* is intrinsic to Socrates, and not to Plato (though both have the property).

It is slightly contentious to identify this relationship between things and propositions as truthmaking. Whether we call it that doesn't matter greatly for my present purposes. What I would call the truthmaker for a proposition might instead, uncontentiously, be called the **intrinsic ground** of that proposition.

2.1.4   Duplicates and natures

An **intrinsic duplicate** of some object x is anything that is intrinsically just like x — that has all and only x's intrinsic properties. The definition can also go the other way: an intrinsic property is one that is shared between all possible intrinsic duplicates.

Switching to talk of duplication is sometimes helpful in deciding whether a property is intuitively intrinsic. We might not know whether *being either a*

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[1]If I were to define extrinsic* so that *being a cube and accompanied by a cube* came out extrinsic*, extrinsic* would no longer be closed under boolean negation, which, given the intuitive characterisation of extrinsic* above, it ought to be.

cube or 1kg in mass is intrinsic, but we can satisfy ourselves by thinking about whether, for each of the different kinds of things that have this property, any duplicate of those things must have it.

Another reason that the definition in terms of intrinsic duplication is attractive is that recasting talk of intrinsic properties in terms of duplication allows us to satisfy nominalistic inclinations by eliminating quantification over properties.

The **intrinsic nature** of something is the property of being a duplicate of that thing; or of having all of its intrinsic properties. Again, intrinsic can be defined in terms of intrinsic nature: an intrinsic property is one that is conveyed by the nature of all of its possible instances. Here, **conveyance** is to properties what entailment is is propositions: a property ϕ conveys another ψ, iff all possible instances of ϕ are also instances of ψ.

By way of analogy, we can also talk about an **extrinsic* duplicate** of x as something that shares all of x's extrinsic* properties, and the **extrinsic* nature** of x as the property of being an **extrinsic* duplicate** of x. For reasons of brevity, however, when I speak of a duplicate x, or of the nature of x, I'll mean an intrinsic duplicate, and the intrinsic nature, respectively.

It is possible to define local intrinsicality in terms of duplication. The definition is: x has ϕ intrinsically iff every possible duplicate of x has ϕ. x fails to have ϕ intrinsically iff every possible duplicate of x fails to have ϕ. As before, ϕ is intrinsic to x iff x either has ϕ intrinsically, or fails to have ϕ intrinsically.

Since duplication is definable in terms of global intrinsicality — in terms of which properties are intrinsic — and we have already seen that global intrinsicality is definable in terms of local intrinsicality, this shows that local and global intrinsicality are interdefinable, via duplication (as shown in figure 2.3).

2.1.5   Intrinsicality and logic

It is intuitively plausible that the set of intrinsic properties is closed under all boolean operations — that is, the following conditions hold:

- If ϕ and ψ are intrinsic, then *being either ϕ or ψ* is intrinsic.

- If ϕ and ψ are intrinsic, then *being both ϕ and ψ* is intrinsic.
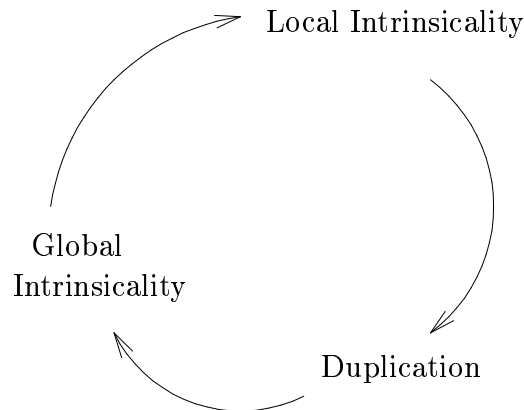
Figure 2.3: Interdefinition of global and local intrinsicality

- If ϕ is intrinsic, then *being not ϕ* is intrinsic.

For example, *being either cubical or massive* is intrinsic because *being cubical* and *being massive* are both intrinsic.

The same seems to be true for extrinsic* properties:

- If ϕ and ψ are extrinsic*, then *being either ϕ or ψ* is extrinsic*.

- If ϕ and ψ are extrinsic*, then *being both ϕ and ψ* is extrinsic*.

- If ϕ is extrinsic*, then *being not ϕ* is extrinsic*.

Conveniently, these results follow from the characterisation of intrinsic in terms of intrinsic duplication (and of extrinsic* in terms of extrinsic* duplication) given above.

There is a problem, or rather, an exception to these principles, though. If properties are individuated extensionally, so that there is precisely one property for each set of objects, then there is a single property, the **ubiquitous property** which is instantiated by every object, and another, the **empty property** which is instantiated by none. These can both be expressed as boolean combinations of intrinsic properties, as well as boolean combinations of extrinsic* properties.

For example, the ubiquitous property is the property of *being both a cube and a non-cube*, but also the property of *being both accompanied by, and unaccompanied by, a cube*. The empty property is both the property of

being either a cube and a non-cube, and *being either accompanied by, or unaccompanied by, a cube.*

Since intuition seems silent on the status of these properties, I think it fair to regard them as neither intrinsic nor extrinsic.

2.1.6   Relational and non-relational properties

Intrinsic properties are often contrasted with **relational** properties, but this is a mistake. The label "relational" should reserved for properties that, as it were, ascribe a relation between the thing that has the property, and something. For example, *being 10 km from a capital city* is a relational property.[2]

Not all relational properties are intuitively extrinsic. Take the property of *having a nose* for example. Apply the duplication test: must any duplicate of me have a nose? The answer seems to be yes. Anything that didn't have a nose would be unlike me in several intrinsic respects. But having a nose is, plausibly, a matter of bearing a certain relation, the part-whole relation, to some other thing, namely, a nose. So *having a nose* is an intrinsic relational property. If duplication is a relation in the relevant sense, it also provides examples of intrinsic relational properties. Being a duplicate of me would be one such.

There can also be extrinsic non-relational properties. *Being such that there are no unicorns* is an extrinsic property (if you doubt this, note that, had there been unicorns, there could have been a duplicate of me that lacks this property) — but it does not involve my being related to anything.

	intrinsic	**extrinsic**
non-relational	*being 5 kg in mass*	*being such that there are no unicorns*
relational	*having a nose*	*being 10 km from a capital city*

Figure 2.4: The orthogonality of relational and intrinsic

Relational and intrinsic are thus completely orthogonal, as shown in figure

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[2]The word "ascribe" may seem inapposite here; however, it is hard to find a substitute that does not lead to problems — see below.

2.4. It is a mistake indeed to conflate intrinsic with non-relational properties or extrinsic with relational ones.

I have thus far been assuming the intuitive characterisation of "relational" which I stated above, and have depended for my argument on examples of relational properties that strike most people as intuitively relational. However, the definition is problematic.

An initial problem concerns the word "ascribe". What is it for a property to "ascribe a relation between the thing that has the property, and something"? We could cash this out modally: a property ϕ is relational iff there is a relation ψ and an individual x such that all possible instances of ϕ bear ψ to x.

But this will not do, as it is painfully dependent on how many relations there are. If there are as many dyadic relations as there are sets of ordered pairs of individuals, for example, then every property is relational. Take any property ϕ: any relation corresponding to a set of ordered pairs where the set of all the first members of the pairs has the extension of ϕ as a subset will satisfy our condition. Of course there is such a set of ordered pairs for any property you care to mention (subject to nominalistic worries about the ontology of mathematics) — so if we think of relations this way, every property is relational.

On the other hand, suppose there are only those relations that correspond to the fundamental polyadic predicates of completed physics. In that case, it is unlikely that any of the properties that we are acquainted with are relational.

There may be other proposals about the individuation of relations that more-or-less satisfy our intuitions about which properties are relational, but in any case the dependence of the distinction on such highly theoretical concerns gives us grounds for scepticism. It is unlikely that our pre-theoretic judgements of properties as relational or non-relational could be sensitive to the one true ontological theory of relations.

It seems to me that what our intuitive judgements of relationality are tracking is not to do with properties, but to do with the concepts and predicates that express them. It is an easy matter to say what it is for a predicate to "ascribe a relation": a relational predicate is simply a monadic predicate that includes a polyadic predicate as a part. So, "is identical to some chair" is relational, because it contains the dyadic predicate "is identical to"; while "is heavy" is non-relational because it contains no polyadic predicate. If concepts can be thought of as predicates in a language of thought, then the same criteria will apply to them.

You may have some lingering desire to say that "is heavy" is relational. There are, I think, two reasons for this. First, *heaviness* is extrinsic, and it is common to conflate extrinsicality and relationality. But, as I have shown above, that is a mistake, even on the assumption which I deny, that relationality is a feature of properties rather than predicates.

Second, ordinary language has a tendency to speak as if the world were language-like in structure. That is why it is so natural to us to reify properties corresponding to every predicate of ordinary language, and to call properties conjunctive, disjunctive, negative, relational, and so on. But in this, I take it, ordinary language is mistaken. It is just that mistake that we make both when we conflate the intrinsic / extrinsic distinction with the relational / non-relational one, and when we think of relationality as a feature of properties at all.

In the following, I will sometimes write of relational properties. This is simply to improve readability, and to secure terminological agreement with other authors. Since I believe that there is no difference between relational and non-relational properties, in every such case, the word "relational" may be deleted without harm.

2.1.7   Pure and impure properties

An impure property is one that, intuitively speaking, makes mention of some particular individual, while a pure property is one that is not impure. (KHAMARA 1988) (HUMBERSTONE 1996)

More precisely, a property ϕ is impure iff there is some individual x, such that, *either* it is impossible that something be ϕ and x not exist, *or*, it is impossible that something be ϕ and x exist. To put this another way, iff ϕ is impure, "ϕy" will always entail "x exists" or its negation. For example, *being Howard*, *having Howard's nose*, and *being such that Howard does not exist* are all distinct impure properties. *Being prime minster*, *having a prime minister's nose* and *being such that noone is prime minister*, on the other hand, are pure.

Intuitively, the distinctions between intrinsic and extrinsic (and even intrinsic* and extrinsic*) seem to apply to impure properties. *Being Howard* and *having Howard's nose* seem intrinsic, while *being such that Howard exists* is extrinsic (but not extrinsic*), and *being accompanied by Howard* is extrinsic*.

Admitting such properties to our existing taxonomy causes problems, how-
ever. A duplicate of Howard need not be Howard, so *being Howard* is not
necessarily shared between duplicates. Nor need a duplicate of Howard have
Howard's own nose — he might instead have a intrinsic duplicate of Howard's
nose. Using our existing techniques, it seems that all impure properties come
out extrinsic. This has led some people to doubt the connection between du-
plication and intrinsicality that I described earlier.

Such radical measures are, I hope, not necessary. One way of patching the
problem is simply to deny that the intrinsic / extrinsic distinction applies
to pure properties; or to deny that it applies in the same way as to pure
ones. Another is to distinguish between mere intrinsic duplicates, and intrin-
sic super-duplicates, where a super-duplicate of x is an object that shares not
only all of x's pure intrinsic properties, but also x's impure intrinsic prop-
erties. It suffices to consider only duplicates when deciding whether a pure
property is intrinsic, but to test whether an impure property is intrinsic, we
need to use super-duplicates instead.

A problem with this idea is that among x's impure properties is the property
of *being x*, so that it would appear that each thing can have only one super-
duplicate: itself. This is not yet a killer problem, but it forces us to beg
some contentious questions in the philosophy of modality. The definition
of intrinsic in terms of duplication involved possibilist quantification: an
intrinsic property is one that is shared between all possible duplicates. The
super-duplication proposal can only work if the domain of quantification here
contains objects that exist at more than one possible world, so that objects
that have different extrinsic properties from those actually had by x can
nonetheless have the property *being x*. Otherwise extrinsic properties will be
shared between super-duplicates, and will count as intrinsic.

On the alternative view about modality, that that possible objects each exist
at only one world, we need to say something else. On this view, it is usual
to talk about objects' counterparts at other possible worlds. But if we are
going to do that, we need to be careful to distinguish *being Howard* from
being a counterpart of Howard. The actual extension of these properties is
the same, so it is easy to get them confused.

Consider the transformation that maps *being Howard* to *being a counter-
part of Howard*, *having Howard's nose* to *having the nose of a counterpart
of Howard*, and *being such that Howard exists* to *being such that a counter-
part of Howard exists*. Let us call this transformation **counterpartisation**.
An impure property that only makes reference to particular objects to say

something about their counterparts, we will call **counterpartised**.

If we restricted ourselves to counterpartised properties, it is easy to get the super-duplication proposal to work. A super-duplicate of x is an object that shares all and only the properties of x that are either pure and intrinsic, or counterpartised and intrinsic. There is no problem with treating counterpartised impure properties just as if they were pure properties.

Indeed, on some accounts of the counterpart relation, the counterpartised properties will turn out to be extensionally equivalent to pure properties. For example, if the counterpart relation is any kind of qualitative similarity relation, the counterpartised properties would be the same as pure properties that replace "counterpart of x" with a specification of the pure properties of x that an object must have in order to qualify as a counterpart of x.

Of the remaining impure properties, the counterpart theorist should say that they are like the ubiquitous property and the empty property: neither intrinsic nor extrinsic.

Another problem concerns the status of properties such as *being Howard or Clark*. Intuitively speaking, this property "makes mention of" a particular individual (of two such individuals, in fact). However, on the precisified definition given above, it will not come out impure. This is because there is no one individual that must exist (or fail to exist) if anything has the property. Rather, there are two individuals, that one of which must exist if anything has the property.

A corollary of this is that the impure properties, on the precisified definition above, are not closed under disjunction, as intuitively they ought to be.

We might try re-writing the definition in order to deal with this. This is, however, problematic. If we are allowed to freely disjoin impure properties, then there is an impure property that is co-extensional with every pure property (if the extension of the pure property is {Charlie, Sharon, Shane, or...}, then the problematic impure property is the property of *being Charlie, or Sharon, or Shane, or...*).

Naturally, this wreaks havoc with theories that individuate properties extensionally. Since I don't wish to foreclose against those theories, I won't try to solve this problem.

2.1.8   Internal / external relations

An **internal relation**, in my usage, is one that supervenes on the intrinsic nature of its relata. An **external relation** is one that is not internal.

An alternative usage due to G.E. Moore, connects internal relations, not with intrinsicality, but with essentiality. In the Moorean usage, "a relation is said to be external if it need not relate the entities it does relate" (KIM AND SOSA 1995, p. 246). I regard this usage as illegitimate since it appears to have its origins in a confusion between intrinsic and essential properties — Moore moves from one usage to another by assuming that an object cannot fail to have its intrinsic properties (MOORE 1959).

Resemblance, and the various kinds of resemblance-in-a-respect (e. g. resemblance in the respect of colour, or in the respect of shape) are the paradigmatic internal relations: if my banana bears the same-colour relation to your lemon, it is in virtue of the fact that my banana is yellow and your lemon is yellow. Another common example of internal relations are comparative relations, such as *being larger than*. To use what Keith Campbell calls "the intuitive picture of divine creation: if God makes an island A with so much rock, soil, etc. as to amount to 20 hectares, and subsequently, an island B of 15 hectares extent, there is *nothing more* needing to be done to make A larger than B." (CAMPBELL 1990, p. 103)

The best known examples of external relations are spatio-temporal relations. If I am 5 meters from you, that is not in virtue of any intrinsic properties that you or I have. Another, less well-discussed type of external relation is typified by the relation of *being equally well thought of by our mutual friends*. The fact that you and I bear that relation to one another does not entail anything about our intrinsic properties — all that is required is that some other persons (our friends) have certain properties.

2.1.9   Intrinsic relations

Among the external relations, we may distinguish two kinds. The **intrinsic relations** supervene on the nature of their relata, as it were, taken as a whole, and not on the surroundings of that whole. The **extrinsic relations**, on the other hand, are in some way dependent on something that is wholly distinct from all of its relata.

For example, *being 5 meters away from* is an intrinsic relation. It does not

supervene on the respective natures of its relata, but, it is often claimed, it does supervene on the nature of whole of them taken together (and usually identified with the mereological fusion of them, see section 3.1). *Being equally well thought of by our mutual friends* is an extrinsic relation — whether you bear it to me depends not on how we are, but on how our friends think of us.

The internal relations are usually included with the intrinsic relations, so that every relation is either intrinsic or extrinsic. As we saw with extrinsic* relations, really what we have here is a three-way distinction, as displayed in figure 2.5:[3]

<p style="text-align:center">internal -   *being the same mass as*   } intrinsic
external {   *being 5 meters away from*
            being equally well thought of by our   - extrinsic
            mutual friends</p>
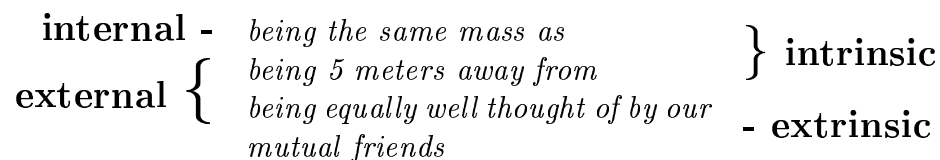
Figure 2.5: Comparison between intrinsicality and internality

Often, it is said that an intrinsic relation supervenes on the intrinsic nature of its relata, together with the perfectly natural relations holding between them (MENZIES 1996, p. 99–100). This definition, however, assumes two elements of a particular theory of intrinsic properties, namely that 1) all perfectly natural properties or relations are intrinsic and 2) all intrinsic properties and relations supervene on the perfectly natural properties and relations.

There are comparatively few intrinsic relations. Those usually cited are spatio-temporal relations; and sometimes, according to some non-Humean theories of causation, the causal relation (MENZIES 1996, p. 98).

2.2 Analysing "Intrinsic"

In the foregoing sections, I have restricted myself to making claims that are either uncontentiously part of the intuitive notion of "intrinsic" that is in

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[3]This distinction among external relations is not the extrinsic* / mongrel distinction recapitulated, however. The extrinsic* relations, analogously to extrinsic* properties, are a proper subset of the extrinsic relations that supervene only on the intrinsic nature of things wholly distinct from all of their relata. The example already given, *being equally well thought of by our mutual friends*, is an extrinsic* relation, while *being closer to the local pub than to* is a mongrel.

use in metaphyusical circles, or definable in terms of "intrinsic" together with neutral logical machinery such as the concept of supervenience.

Is it possible to do more? It would be nice to analyse "intrinsic" in terms of better understood metaphysical theories — in modal terms, for example. G.E. Moore once proposed that the test of whether a thing is intrinsically valuable should be whether that thing would be valuable even if nothing else existed. Gold is certainly a valuable commodity — but it is not intrinsically valuable on Moore's test because there is nothing good about gold nuggets floating in the void. Moore's test is a modal one because in order to decide whether a value (or, more generally, a property of any kind) is intrinsic, we have to evaluate a certain counterfactual conditional: "Were there gold, but nothing else in the world, would gold be valuable?"

2.2.1   Modal analyses

Variants on Moore's test have a long history of counterexamples (Lewis 1983a) (Langton and Lewis 1998) (Marshall and Parsons 2001). Rather than recapitulate them here, I offer an argument that no modal analysis of "intrinsic" is possible.

Imagine a god who is omniscient with regard to all modal and logical matters of fact — of which possible objects there are, which are in each possible world, which worlds are accessible to each other and so on — but ignorant with regard to all else. This god is acquainted with the extensions of the properties *being a positron* and *being an electron*, and knows, for example, that these sets are disjoint. But he does not know which set is the extension of which property, or equivalently, which things are positrons and which are electrons, because that is not a modal or logical matter of fact.

This shows, unexcitingly, that the positron/electron distinction is not definable in modal terms, because the god is ignorant of it. What I am going to show now is that the god is ignorant of the distinction between two properties, one of which is intrinsic, and the other extrinsic. That is, though the god is acquainted with the extensions of these properties, he does not know which extension belongs to which property, because that would require him to have knowledge of which objects are positrons and which electrons.

There is a possible electron that is the only thing that exists at its world — it is, as I will say, **lonely**. Call that electron e_l. And there is also a possible lonely positron; call it p_l. The only difference between e_l and p_l is that one

is a positron, and the other an electron. So there is no difference between
them that is knowable to the god. Imagine the set E, containing all the
electrons, and the set, $E*$ that contains all electrons *except* e_l, and contains
p_l, and nothing else. The god should be unable to distinguish E from $E*$.
If he could distinguish them, then he would be able to distinguish e_l and p_l,
because e_l is in E, but not $E*$, and p_l is in $E*$ but not E. And if e_l and p_l
were distinguishable to the god, then he would be able to tell the difference
between positrons and electrons, which is no matter of merely modal fact.

Now E is the extension of the property *being an electron*, which, we may
assume, is intrinsic. $E*$ is the extension of *being either an accompanied
electron, or a lonely positron*, which, intuitively, is extrinsic. If the god could
tell the difference between the extension of an intrinsic property and that
of an extrinsic one, then he would know of a difference between E and $E*$,
which, as we have seen, he does not. All that the god knows about properties
is their extensions. So the god cannot tell the difference between intrinsic
and extrinsic properties.

Since the god is omniscient with regard to all modal and logical matters
of fact, it follows that modality and logic alone do not suffice to analyse
"intrinsic". If they did, then they would suffice to analyse "electron", which
would be absurd.

2.2.2   Analyses involving naturalness

Another tradition, mostly carried out by David Lewis, attempts to analyse
"intrinsic" with the resources of a theory of natural properties. (LEWIS
1983B, pp. 25–29) (LEWIS 1986, p. 62) (SIDER 1996B)

The Lewis analysis

Lewis claims that

- there exists a class of perfectly natural properties, which

- are all intrinsic, and

- serve as a supervenience basis for all the intrinsic properties.

With these claims Lewis is able to define duplication and then intrinsicality. Two things are duplicates iff they have exactly the same perfectly natural properties, and, their parts can be put into correspondence in such a way that corresponding parts have exactly the same perfectly natural properties, and stand in the same perfectly natural relations.

Lewis's three claims, however, may seem controversial. Perhaps there are no perfectly natural properties, or perfectly fundamental objects, but ever more levels of being waiting to be discovered — 'turtles all the way down'. If this were the case, all that we could say would be that the property of *being an up quark* is more natural than *being a proton*, and whatever properties of even finer grained matter turn out to be responsible for some object's being an up quark would be more natural yet, but none of these properties is the *most* natural.

Or perhaps there might be extrinsic perfectly natural properties, or intrinsic properties that do not supervene on the perfectly natural ones. It is hard to imagine what sorts of properties either could be, but it does not seem to be part of the concept of intrinsic that there are none (more likely, it is part of the concept of a natural property).

The Langton/Lewis analysis

A different analysis in this tradition, by Rae Langton and David Lewis, offers to deal with the first of these problems, and at the same time, accomodate the ideas that attracted people to the Moorean test. Their key idea, drawing on earlier work by Jaegwon Kim, was that an intrinsic property is one that is independent of accompaniment, which is to say that P is intrinsic iff the following four conditions are all met:

    ‹ It is possible for a lonely object to have P.

    › It is possible for an accompanied object to have P.

    fi It is possible for a lonely object to lack P.

    fl It is possible for an accompanied object to lack P.

This works very nicely for the obvious examples. It works for *being cubical, being 50 km from a capital city*, and *being lonely* (intrinsic, extrinsic, extrinsic, respectively). But it doesn't work for every property. Langton and Lewis

note that disjunctive properties cause trouble: they give the example of *being cubical and lonely, or else non-cubical and accompanied*. This property is independent of accompaniment, but intuitively is extrinsic. Other disjunctive properties are intuitively intrinsic (the property of *being cubical or spherical*, for example), so a new test must be prescribed for them.

And that is, indeed, what Langton and Lewis do: they call the intrinsic properties that are not disjunctive "basic intrinsic", and apply the independent of accompaniment test to them. So, a property is basic intrinsic iff it is:

- not a disjunctive property, and,

- not the negation of a disjunctive property, and,

- independent of accompaniment.

They then define the relation of intrinsic duplication as the relation that holds between two objects iff they share all their basic intrinsic properties, and an intrinsic property as one that can never differ between intrinsic duplicates (actual or possible). Equivalently, one could say that an intrinsic property is one that supervenes on the basic intrinsic properties of its object. Intrinsic in this sense is applicable to even disjunctive properties.

The Marshall/Parsons counterexample

In (Marshall and Parsons 2001) (reproduced as appendix D), Dan Marshall and I described a counterexample to the Langton/Lewis analysis. Our counterexample was the property *being such that there is a cube* (on the assumption that *being a cube* is intrinsic). Or, strictly speaking, it is the family of such properties of *being such that there is something that is ϕ*, where ϕ is an intrinsic property; also relational-seeming properties that convey these properties, such as *being within 5 meters of a cube*.

Our complaint was two-fold. First, that the Langton/Lewis analysis might well mis-identify these properties as intrinsic, when, intuitively, they are extrinsic. The problem properties are, nevertheless, independent of accompaniment. All the required possibilities are there, realised by the following possible worlds (for the original example of a problematic property):

< A world containing nothing but two cubes.

> A world containing nothing but one cube.

fi A world containing nothing but two non-cubes.

fl A world containing nothing but one non-cube.

Because of this, if the problematic property is not to be a straight counterexample to Langton and Lewis, then it must be disjunctive, or the negation of a disjunctive property. We thought that it was neither, even by the lights of Langton and Lewis's own theory. For the problem property to be disjunctive, according to the Langton/Lewis analysis, it must be less natural than its own disjuncts. These disjuncts could either of the following pairs:

- *being a cube* or *being accompanied by a cube*

- *being a cube* or *being a non-cube accompanied by a cube*[4]

On the Langton/Lewis analysis, *both* of the disjuncts of one of these pairs must be more natural than the problem property. We granted that *being a cube* is, but saw no reason to suppose that either *being accompanied by a cube* or *being a non-cube accompanied by a cube* are any more natural than *being such that there is a cube*.

In a reply to our paper, Langton and Lewis reported that they have an intuition to the effect that both *being accompanied by a cube* and (worse, they say) *being a non-cube accompanied by a cube* are more natural than *being such that there is a cube*. (LANGTON AND LEWIS 2001) So, a stalemate has been reached with regard to our first complaint. If all we had to go on, in deciding the facts of relative naturalness, were the brute intuitions of philosophers, it would be our word against theirs.

This brings us to the second complaint. Marshall and I also argued that the types of theory of naturalness of properties that are advanced to explain the brute intuitions of philosophers do not predict the intuitions that Langton and Lewis now report. For that reason we concluded that "If the Langton/Lewis analysis of "intrinsic" is to resist our counterexample, it will need supplementation with a theory of naturalness that is, as yet, unarticulated." (MARSHALL AND PARSONS 2001, final paragraph)

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[4] The first of these pairs are the "disjuncts" we assumed in (MARSHALL AND PARSONS 2001); the second are an alternative suggested by (LANGTON AND LEWIS 2001) which they say are "worse" than ours.

The best way to adjudicate between the Langton/Lewis intuitions and ours is to consult theories of naturalness. But there is no developed theory of relative naturalness, in the way that there are highly developed theories of absolute naturalness, such those of D.M. Armstrong (ARMSTRONG 1978B), Barry Taylor (TAYLOR 1993), or Lewis himself (LEWIS 1983B). These are the theories that we concluded would not predict the facts of relative naturalness that Langton and Lewis need. So our conclusion still stands.

2.2.3   Why do we need an analysis?

For the reasons given above, it seems that intrinsicality is unanalysable; or at least, it is not possible to give an enlightening analysis — an analysis that doesn't feel circular in the way that analysis in terms of duplication or local intrinsicality does (see sections 2.1.1 and 2.1.4). Should we be worried?

The only way to answer this, I think, is to compare the metaphysical theory of intrinsicality to other areas in which metaphysicians have attempted to employ analysis. Take, for example, the analysis of mental states typified by analytic behaviourism, and its successor analytic functionalism. These analyses are designed to answer the challenge of dualism: the several ways in which our experience of ourselves as objects with mental states seems incompatible with physicalism. Analytic behaviourists and functionalists want to show that there is no such incompatibility by showing how mental states can be analysed in physical terms. The analysis of mental states is a way of establishing reductionism about mental states, in order to protect physicalism from refutation.

In contrast, neither physicalism, nor any other comparable doctrine is up for grabs in the debate over the analysis of "intrinsic". So far as I know, no-one in the literature has made explicit why we might prefer reductionism rather than anti-reductionism about intrinsicality to be true, or vice versa. I can't think of any reasons for preferring one doctrine over the other, and in view of the lack of success of analysis, I take anti-reductionism about intrinsicality as a working hypothesis. It is simply a brute fact about some properties that they are intrinsic (or, more nominalistically, about some pairs of objects that they are duplicates).

How we discovered that weight is extrinsic

From time to time, we discover these brute facts. This seems to have happenned about the time of transition from Aristotelean physics to Newtonian.

It is fair to describe Aristotelean physics as endorsing the doctrine that weight is an intrinsic property. Aristotle and his followers explained the motion of inanimate matter in terms of weight. Earth is heavy, and so tends to move towards the center of the universe (i.e. to fall). Water is also heavy, though less heavy than earth, and will move towards the center, insofar as its path is not blocked by earth. Fire and air, on the other hand, are light (if Aristotle's physics had been more mathematical, he would have said they had negative weight) and move away from the center of the universe. (TORRETTI 1999, pp. 8–13)

According to Aristotelean physics, the lightness or heaviness of a lump of matter depends only on its constitution — the relative amounts of the basic elements contained in it, and not on anything else. Not, for example, on how far it is from the center of the universe, or what type of matter is there already.

By contrast, the Newtonian concept of weight as the force due to gravity is extrinsic. It depends not only on the intrinsic mass of an object, but also on the mass of the Earth (I am thinking here of Newtonian weight as weight-on-Earth).[5]

It is tempting to say "Aristotelean weight is intrinsic, Newtonian weight is extrinsic". We should be careful: I have thus far been assuming that intrinsicality is a feature of properties. If we carry on with that assumption, to say "Aristotelean weight is intrinsic" would require that Aristotelean weight be a property. But there is no such property — Aristotelean physics was false. What we should say instead of "Aristotelean weight is intrinsic" is "according to Aristotelean physics, weight is intrinsic".

Part of what went on, therefore, when Newtonian physics displaced Aristotelean, is that natural philosophers stopped believing that weight was intrinsic, and came to believe that it was extrinsic.

This probably happened in late medieval times. In a 14th Century thought experiment due to Albert of Saxony, an object falls into a hole that penetrates

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[5]Subject to my doubts about the propriety of talking about relational properties (see section 2.1.6), Newtonian weight also appears to be relational, since having a weight seems to involve bearing a distance relation to Earth.

right through the center of the earth. According to Aristotle, this object should accelerate towards the center, and then stop dead on reaching it. This seems strange to us, and to Albert, who thought that instead the object should zip past the center, slow down, and return. (TORRETTI 1999, p. 10n) Albert's suggestion requires the very un-Aristotelean idea that falling objects are being *pulled* towards the center of the universe, rather than moving there out of their own natural motion. From here it is only a small step to the idea that weight is not an intrinsic property, but rather the strength of that external pull.

Scepticism about "intrinsic"

There is one other advantage (other than establishing reductionism) to finding an analysis of intrinsic. This is to refute scepticism about intrinsicality — the view that there is no distinction between intrinsic and extrinsic properties. For some reason, this seems to have been the orthodoxy in modern philosophy between about the time of Leibniz and the beginning of the 20th Century, in spite of the obviously counterintuitive results that it produced. A good example of this is the weird things that were said about change: Leibniz's view that a man in India undergoes a change when his wife dies in Europe (MATES 1986, p. 214), which was echoed as if it were obvious as late as McTaggart (MCTAGGART 1927, s. 309).

There are thought to be reasonable arguments against the sceptic about modality (LEWIS 1986, pp. 5–20) and naturalness (ARMSTRONG 1978A) (ARMSTRONG 1978B) (LEWIS 1983B) — if we could analyse "intrinsic" in terms of modality and/or naturalness, we could recruit those arguments against the sceptic about intrinsicality. But scepticism about intrinsicality is in such bad shape, that it is no loss to be unable to appeal to that argument.

Chapter 3

Parts and Wholes

Since one of the important theories of persistence involves claims about temporal parts (see chapter 4), and the important criticism of this theory call into question the tenability of this idea, it is helpful to review the background theory of parts that I will be dealing with.

In this chapter, I will follow the traditional approach of exploring the part-whole relationship by discussing certain formal systems called "mereologies". These formal systems are usually modeled after formal logics, with an additional primitive predicate, and a number of additional axioms making use of that predicate.

Among these systems, one has pre-eminence — this is the so-called **classical mereology**. Since I believe that classical mereology is, in a sense to be explained in section 3.3, the one true mereology, it is that system that I will describe. However, I'll also describe the features of classical mereology that some find doubtful, and explain why I accept them.

Finally, I discuss some mereological and quasi-mereological proposals concerning atomism that are left undecided by classical mereology (section 3.5). Among these is the doctrine of arbitrary undetached parts, or DAUP. I reject DAUP, but not for the usual reasons, which turn on a rejection of classical mereology. In fact DAUP is independent of classical mereology (section 3.5.3).

3.1   Classical Axiomatic Mereology

The language of mereology is usually borrowed from the first order predicate calculus, including the usual truth-functional logical connectives, quantifiers, and an identity predicate. To this is added a primitive predicate, usually either "$<$" or "$\circ$", the intended interpretations of which are "is a part of" and "overlaps" (or, "has a part in common with"). Whichever is not taken as primitive can be defined in terms of the other:[1]

Def$_<$ $x < y =_{df} (\forall z)(z \circ x \supset z \circ y)$

Def$_\circ$ $x \circ y =_{df} (\exists z)(z < x \wedge z < y)$

Note that the definition of $<$ in terms of $\circ$ has the result that everything is a part of itself. This is intentional. There is a notion of parthood, called "proper parthood" that excludes things from being their own parts. Henceforth, when I say "part" I'll always mean proper or improper part — that is, the sense of parthood that is reflexive, that makes each thing its own part. Proper parthood is definable in terms of parthood:

Def$_\ll$ $x \ll y =_{df} x < y \wedge \sim y < x$

It will also be handy to have a symbol for two things being mereologically disjoint, or not sharing any common parts:

Def$_\wr$ $x \wr y =_{df} \sim x \circ y$

Our next definition is more than a convenience. It is the often contentious concept of mereological fusion, or summation. The summation operator, "σ" is used in a similar way to the definite description operator, in terms of which it is defined:

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[1] The definitions below are taken from (GOODMAN 1951, pp. 44–46) and (SIMONS 1987, p. 37). Strictly speaking, the formulae of classical mereology that I present are schemae: lower-case letters $x, y, \ldots$ are placeholders for individual denoting expressions, uppercase letters $F, G, \ldots$ are placeholders for predicates. This usage makes many of the expressions easier to read, and also makes it possible to give an axiomatic basis for classical mereology without second order quantification (by making it possible to state formulae such as GSP, for example).

$\text{Def}_\sigma \ (\sigma x)(Fx) =_{df} (\iota x)(\forall y)(x \circ y \equiv (\exists z)(Fz \land z \circ y))$

Intuitively, the sum of the Fs is the whole that, taken together, the Fs *exactly* compose. So, for example, we can speak of the fusion of all the states and territories of Australia. We have another name for this fusion: Australia.

The contentious issue about fusion is the question of whether $(\sigma x)(Fx)$ is well-defined for any non-empty predicate F. Is there a fusion of all the green things? All the grue things? Everything that is either one of the queen's earrings or the oldest rabbit in Australia?

Though Def_σ does not presuppose any answer to these questions, Classical Mereology answers "yes" to all of them. That is, it affirms what Simons (1987) calls the **General Sum Principle**, or GSP:

GSP $\ (\exists x)(Fx) \supset (\exists x)(\forall y)(x \circ y \equiv (\exists z)(Fz \land z \circ y))$

We can make two more convenience definitions in terms of the fusion operator. The first is binary fusion, "$+$", $x + y$ being the fusion of x and y; the second is mereological difference, "$-$", $x - y$ being, intuitively, the part of x that remains after y is removed:

$\text{Def}_+ \ x + y =_{df} (\sigma z)(z < x \lor z < y)$

$\text{Def}_- \ x - y =_{df} (\sigma z)(z < x \land z \wr x)$

With all these definitions, the only axioms that need to be added to first order predicate logic with identity and definite descriptions in order to get Classical Mereology are:

Asym $\ x \ll y \supset \sim y \ll x$

Trans $\ x \ll y \land y \ll z \supset x \ll z$

WSP $\ x \ll y \supset (\exists z)(z \ll y \land z \wr x)$

GSP $\ (\exists x)(Fx) \supset (\exists x)(\forall y)(x \circ y \equiv (\exists z)(Fz \land z \circ y))$

Asym and Trans ensure that the part-whole relation is asymetrical and transitive, respectively. WSP, the **Weak Supplementation Principle**, expresses a weak extensionality constraint: nothing can have precisely one proper part — anything that has a proper part must have another, disjoint from the first. Finally, there is the already mentioned General Sum Principle.

3.2   The Project of Axiomatic Mereology

By itself, an axiomatic system such as that presented in 3.1 tells us nothing about the part-whole relation. We need to know how we should interpret it. Let us start with the idea that formulae of mereology are valid iff they are conceptual truths when interpreted so that < means the same as "is a part of". This way of thinking, **mereological analyticism**, takes mereology to be a kind of conceptual analysis.

Aside from general scepticism about the possibility or value of conceptual analysis, there are two problems with this idea.

3.2.1   Regimentation in mereology

First, the conceptual analysis, if any, embodied by formal mereology is obviously regimented in various ways. There are ordinary language counterexamples to the most basic theorems of classical mereology, if they are construed as a formalisation of ordinary usage. For example, from a list compiled by Nicholas Rescher:

> 1. Many legimate uses of "part" are nonreflexive, and do not countenance saying that a whole is a part (in the sense in question) of itself. The biologists' use of "part" for the functional sub-units of an organism are a case in point.
>
> 2. There are various nontransitive senses of "part." In military usage, for example, persons can be parts of small units, and small units parts of larger ones; but persons are never parts of large units. Other examples are given by the various hierarchical uses of "part." A part (i.e., biological sub-unit) of a cell is not said to be a part of the organ of which that cell is a part.
>
> <div align="right">(RESCHER 1955, pp. 9–11)</div>

Little would remain of formal mereology if these types of criticism had to be accepted. That is not to say that they should be ignored. Rescher's counterexample (1) is best answered by pointing out that all mereologies have the resources for both a reflexive predicate (such as my <) and an anti-reflexive one (my ≪), between which ordinary language's "is part of"

may be ambiguous. (2) is best answered by the suggestion that in ordinary language, quantification is often implicitly restricted to a sub-domain that is relevant to the topic at hand. When I say truly "All the students are here", I mean all the students in my tutorial, not all the students there are. The non-transitive ordinary uses of "part" are implicitly restricting quantification to parts of a certain kind.

The force of Rescher's counterexamples is to show that formal mereology is trying to track something other than mere ordinary usage.

3.2.2 Ontological significance in mereology

Second, mereology is taken to be ontologically significant in a way that no conceptual analysis can be. For example, it is a contestable, and often contested, consequence of classical mereology that there is a scattered object which has all of the Queen's earings, and the oldest rabbit in Australia as its parts.[2] It is not just that "we would not say" that such an object exists — that type of objection can be answered by the same answer we gave to Rescher's doubts about transitivity.

Objections to scattered objects have to be understood as ontological objections, akin to nominalistic objections to properties, numbers, or classes. Otherwise it would be legitimate to respond to them as Nelson Goodman does:

> The usual objection [to GSP] is to name some two very different and widely seperated individuals and ask if it is reasonable to suppose that they have a sum which is an individual. Such an objection misses the point. If the Arctic Sea and a speck of dust in the Sahara are individuals, then their sum is an individual... The supposition that bizarre instances demonstrate that two individuals can fail to have a sum betrays a misunderstanding of the range of our variables. (GOODMAN 1951, p. 46)

Goodman's response to the doubter of scattered objects is unsatisfying because the objection was not that formal mereology has made a mistake about

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[2]More precisely, the object I have in mind is the one that overlaps all and only those things that overlap either one of the earings or the rabbit.

what falls under the concept of an individual — rather, it is that there might be no such things as the individuals in question.[3]

In order to make sense of this objection, and the fact that it is not handled as easily as Goodman makes out, we need to understand mereology as a substantive metaphysical theory, rather than a mere piece of conceptual analysis.

To put this point another way, mereology is normally interpreted in a *realistic* way. In believing a certain mereological system to be the correct one, we are believing **mereological realism** with regard to it: that there is a domain of objects which satisfies the theorems of that mereology, when $<$ is interpreted as "is part of", in that phrase's most general sense, and when the quantifiers are taken to be unrestricted.

3.3   Classicalism

The mereological theory I believe is mereological realism with regard to classical mereology, or as I will call it for short, **classicalism**.[4] Classicalism has two important features: extensionality and unrestricted composition, which I will now describe.

3.3.1   Extensionality

To put it intuitively, the extensionality of mereology lies in the fact that no two things can be made of the same parts. This seems to be an important truth. Suppose I have a collection of electronic parts that could be used entirely to make either a computer or a video recorder. If the parts would be entirely used up making either of these things, then I cannot make both a computer *and* a distinct video recorder (though perhaps I could make a single device that does the jobs of both).

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[3]That Goodman gives this response does not show that he does not take mereology "realistically" in the sense given below. Goodman appears to take the ontological commitments of mereology quite seriously — insofar as this is compatible with his relativism (see the quote given on page 38).

[4]I use the name "classicalism" rather than "classicism" because the name is derived from "classical mereology", not "classic mereology.

To translate this into the formal language of mereology is non-trivial; however, there are several theorems of classical mereology that come close to the idea. One of these is the axiom WSP (see section 3.1):

WSP $x \ll y \supset (\exists z)(z \ll y \wedge z \wr x)$

This says that nothing can have precisely one proper part; moreover, anything that has any proper parts at all has two disjoint proper parts. Perhaps I could build my computer into a video recorder by making it a proper part of the video recorder. But I can only do that by adding something else.

I call this feature of classical mereology "**vertical extensionality**". Vertical, because it concerns the relationship between relatively fundamental objects and their proper wholes.

But this is not the only extensional feature of classical mereology. WSP leaves it open whether, supposing that I have built a computer out of a certain bunch of parts, there is not also a video recorder built out of those parts that is neither a proper part of the computer, nor has the computer as a proper part. The computer and the video recorder, perhaps, are two things that just have all the same proper parts. Something seems wrong with this scenario, and it is worth stating a formula of classical mereology that rules just this type of situation out:

PPP $\left((\exists z)(z \ll x) \wedge (\forall z)(z \ll x \supset z \ll y)\right) \supset x < y$

This theorem, which Simons (1987, pp. 28–29) calls the **Proper Parts Principle**, or PPP, is a tidied up version of the principle that informal mereologists cite by saying "No two things have the same parts". The tidying up that is required is, first, that "parts" must be understood as meaning "proper parts" in order to avoid triviality; and, second, that the principle only applies to complex objects, as all atoms have entirely the same proper parts, namely, none.

PPP is not an independent axiom of classical mereology, but follows from the much stronger, and independently controversial GSP (see section 3.3.2).

PPP expresses what I call "**horizontal extensionality**", because it concerns the relationship between things that are, as it were, competing for the same parts.

A good way to explain the difference between horizontal and vertical extensionality is to contrast the part-whole relation with other types of composition relation, for example, the relationships that hold between classes and their members, on the one hand, and ordered pairs (more, generally, ordered n-tuples) and their members on the other (figure 3.1).

	wholes	**classes**	**n-tuples**
vertical extensionality	3	7	7
horizontal extensionality	3	3	7

Figure 3.1: Comparison of vertical and horizontal extensionality

Classes, like mereological wholes, are horizontally extensional, because there is only one class of any given collection of members. But the classes are not vertically extensional, because the singleton class of an individual is distinct from the individual; and the singleton class of that class is distinct from both. n-tuples, like classes, and unlike mereological wholes, are not vertically extensional: the pair $\langle a, b \rangle$ is distinct from the pair $\langle \langle a, b \rangle, a \rangle$. Unlike classes, however, they are also not horizontally extensional, as $\langle a, b \rangle$ is distinct from $\langle b, a \rangle$.

Goodman seems to have described this distinction under the labels "extensionalism" (his name for my horizontal extensionality) and "nominalism" (his name for my vertical extensionality):

> [T]he relationship between nominalism and extensionalism... springs from a common aversion to the unwonted multiplication of entities. Extensionalism precludes the composition of more than one entity out of exactly the same entities by membership; nominalism goes further, precluding the composition of more than one entity out of the same entities by any chains of membership. For the extensionalist, two entities are identical if they break down into the same members; for the nominalist, two entities are identical if they break down in any way into the same entities. The extensionalist's restriction upon the generation of entities is a special case of the nominalist's more thoroughgoing restriction. (GOODMAN 1972, p. 159)

However, this use of "nominalism" is non-standard, so I retain my usage. Also, Goodman's way of making the distinction assumes atomism: by "members" here, he means "atoms". The principles WSP and PPP do not assume atomism, and it is to these that I tie the distinction.

Objections

Extensionality is often attacked on the grounds that it identifies objects that are in fact distinct. The distinctness, it is alleged, can be demonstrated by means of appealing to predicates that apply to one complex object, and not another, where these objects have all and only the same proper parts.

The predicates involved come in two varieties, those containing either tense, or a specification of a time; and those containing a modal operator. These two types of predicates correspond to two types of argument against extensionality. I state each briefly here:

Temporal argument against extensionality Consider the relationship between Josh and Josh's body (or to give it a proper name, Body). Josh and Body share all their proper parts. But at some time in the future, suppose, Josh's personality will be transferred into a robot body, in such a way that Josh will still exist, but Body will not. But that means we can say truly of Josh "... will be a robot", while we cannot of Body. Since we cannot substitute "Josh" and "Body" in a seemingly transparent context within a sentence without changing the truth value of that sentence, Josh and Body are not identical.

Modal argument against extensionality Consider Josh and Body again. This time suppose that Josh will not actually inhabit a robot body, but is given an opportunity to do so, which he turns down. We can say truly of Josh "... he might have been a robot" But we cannot of Body. Since we cannot substitute "Josh" and "Body" in a seemingly transparent context within a sentence without changing the truth value of that sentence, Josh and Body are not identical.

The relationship between Josh and Body that makes these arguments possible is one that occurs in many contexts, so that it is possible to multiply these arguments indefinitely. The arguments can be run, for example, with persons and their bodies; social collectivities (i.e. associations, nations, classes, etc.) and their members (COPP 1984); artifacts such as statues and ships, and the material out of which they are made (GIBBARD 1975); properties and their extensions. This relationship is called "**constitution**".

When we believe that one thing (like a body, or a collection of individuals) constitutes another (like a person, or an association) we are very apt to think,

pre-theoretically, that both things share all the same parts, while nonetheless also wanting to hold that those things differ in tensed, time-indexed, or essential properties.

It would be getting ahead of myself to reply immediately to these arguments — especially the temporal argument, a variant of which we will meet again in section 5.4.1. I will, however, say something about the arguments more generally. I would like to hold that **constitution is identity**. That is, if x constitutes y, then x is y. I believe this principally because no opposing view seems really tenable. If the doctrine that constitution is identity is defensible, then no constitution argument can threaten extensionality. Of course, the constitution arguments themselves attack the doctrine; but by themselves, they give us no rival account of constitution.

3.3.2 Unrestricted Composition

Unrestricted composition is the feature of classical mereology enshrined in the axiom GSP:

GSP $(\exists x)(Fx) \supset (\exists x)(\forall y)(x \circ y \equiv (\exists z)(Fz \wedge z \circ y))$

According to GSP, for any predicate F, if F is satified at all, there is something that overlaps all and only those things that overlap the Fers. This thing is often known as the fusion, or sum of the Fers. GSP is sometimes stated with regard to sets, rather than predicates. It entails, as mentioned before, that there are such things as the sum of all the grue things, the sum of all the queen's earrings and the oldest rabbit in Australia, and so on.

The plausibility of unrestricted composition is connected with the generality of mereological concepts. We do not often talk of the arbitrary sums mentioned above because in the different contexts in which we use the part-whole concept, we are interested in various somewhat restricted types of part. But according to mereological realism, mereology attempts to describe the reality which underlies part-whole talk in *all* contexts.

There are many contexts in which we would like to talk about objects that in other contexts would seem strange, arbitrary, or scattered. To give an example, supposing we accept the doctrine that constitution is identity mentioned in the previous section. If we do that, then we think of associations as sums of the individuals that make them up. There does not seem to be

any metaphysically necessary limit to what collections of individual agents can make up an association, though of course not every such collection does make up an association.

Should we think that when, as it were, a new association is formed — when its charter is signed, perhaps — an entirely new material object has come into being? Surely not, I think. That object, which is the sum of those individuals was there all along, though it was not an association until that moment.

3.4   Partial Identity

Donald Baxter and David Lewis have urged that mereological relations are a kind of identity relation (or, perhaps, are relevantly like identity) so that GSP is unproblematic. The idea is that, in talking about identity, we never doubt that if one thing exists, then anything identical to it exists too. Similarly for fusion: if two (or more) things exist, we should never doubt that their fusion exists. Thus Lewis writes:

> If Possum exists, then automatically something identical to Possum
> exists; likewise if Possum and Magpie exists, then automatically their
> fusion exists. Just as Possum needn't satisfy any special conditions
> in order to have something identical to him, so Possum and Magpie
> needn't satisfy any special conditions in order to have a fusion.
> (Lewis 1991, p. 85)

There is something tempting and intuitive about the idea that the parts of an object just are that object. But we need to be careful here. Of course, the fusion of the parts of an object is that object — but this is a triviality that gives us no reason to believe in arbitrary fusions. What Baxter and Lewis need is a sense in which *the parts themselves* are the object, and it's not clear that there is anything tempting or intuitive about this.

Baxter tries it to make it so by means of an intuition pump:

> Suppose a man owned some land which he divides into six parcels.
> Overcome by enthusiasm for the Non-Identity view, he might try
> to perpetrate the following scam. He sells off the six parcels while

> retaining ownership of the whole. That way he gets some cash while
> hanging onto his land. Suppose the six buyers of the parcels argue
> that they jointly own the whole and the original owner now owns
> nothing. Their argument seems right. But it suggests that the
> whole was not a seventh thing.   (BAXTER 1988, p. 579)

Baxter is right that, believing that wholes are identical to their parts, he has
a neat explanation of why the original owner is in the wrong. But is this the
only possible explanation?

One reason for thinking so is some form or other of **Hume's Principle** that
there can be no necessary connections between distinct existences. The point
of the example is that the ownership of the whole seems to go *necessarily* with
the ownership of the parts. This appears to constitute a counter-example to
Hume's Principle, *unless* the whole is not distinct from the parts; and if it is
not distinct from the parts, it is identical to them.

It's hard to know how to understand Hume's Principle. We might think that
it rules out any necessary connection between x's being F and y's being G,
where x and y are distinct. But in order for any such formulation to work, we
need to restrict F and G. Perhaps x is Socrates, y is me, F is wisdom, and
G is the property of being such that Socrates is wise — it ought not to follow
that I am identical, in any sense, to Socrates. A restriction in the spirit of
Hume himself would be that the principle only applies where x's being F and
y's being G are distinct ideas. The idea here is that the principle should allow
necessity where it reduces to analyticity, and deny any necessary connections
that do not so reduce.

In this formulation, Hume's Principle is still a very strong metaphysical con-
straint. The trouble with Baxter's argument, understood this way, is that,
precisely because we can say *a priori* that something is wrong with the s-
cam, it looks as though the the necessary connection between the ownership
of the whole of the land and the ownership of its parts is conceptual, not
metaphysical. That is, it is our concept of ownership that makes the neces-
sary connection, not any spooky connection between distinct existences out
there in the world.

This point can be made vivid with an intuition pump similar to Baxter's own:
suppose that ownership of a piece of land was equivalent in law to ownership
of a title deed. Overcome with enthusiasm for Hume's principle, the owner
of this land attempts to sell the land, while retaining the deed. He then
insists that his deed gives him rights over the land. The purchaser argues

that having bought the land, she now owns the deed as well. her argument seems right. Does this suggest that the deed is identical to the land?

I should hope not. But this case seems quite analogous with Baxter's. In either case, it is the legal concept of ownership that is responsible for our *a priori* conviction that the original owner is in the wrong. Hume's principle may show that ownership of the parts, or of the deed, is not distinct from ownership of the whole, but it does not show that the parts themselves, or the deed itself, is not distinct from the whole block of land.

Thus, while I agree with Lewis and Baxter about GSP, I disagree with their method of argument. An unsound argument can have a true conclusion and, in my view, theirs is an example.

3.5   Principles of Partition

There is an interesting asymetry in the way that mereological classicalism treats parts and wholes. Classicalism accepts arbitrary fusions of objects; would it not also seem equally reasonable to accept arbitrary partitions?

In fact, classicalism has nothing to say about partition: classical mereology is satisfied in a universe containing just one atom, and in universes containing no atoms at all. Many mereologists have been tempted to say something one way or the other about how many and what types of parts things have, but it seems to me that all such hypotheses are empirically up for grabs, and therefore not suitable to include in a metaphysical theory of part-whole.

I will now discuss some of the hypotheses that have been suggested, and say why I do not accept them.

3.5.1   Atomism and anatomism

A mereological **atom** is an individual that has no proper parts. In my usage, **atomism** is the view that everthing is composed of atoms, or equivalently, that everything has an atom as a part; **anatomism** is the view that there are no atoms. Materials of which anatomism is true are sometimes described as "**gunk**", a usage derived from Lewis (1991, p. 20).

These doctrines can be expressed in the language of mereology, if we define a predicate A, "is atomic" as

Def_A $Ax =_{df} \sim(\exists y)(y \ll x)$

then, following Simons (1987, p. 42), we can state atomism and anatomism with the following formulae:

Atom $(\forall x)(\exists y)(Ay \wedge y < x)$

Anatom $(\forall x)(\exists y)(y \ll x)$

Notice that anatomism is not simply the denial of atomism, and that it is possible to formulate a middle position, that denies both. This would be the view that there are atoms, but not everything has any atomic parts:

Hybrid $(\exists x)(Ax) \wedge (\exists x)(\forall y)(y < x \supset (\exists z)(z \ll y))$

According to Simons, this "hybrid position... has rarely been seriously entertained" (SIMONS 1987, p. 42). However, it is not so weird as might appear. There are two positions from which it might seem plausible. Both are connected with the topology of matter and space.

First, we might think that all extension is owed to non-atomistic matter — that no sum of spatial atoms has an extension — but also think that things are touching when they have part of their boundaries in common. Since things can touch even at a single point — a single spatial atom — objects boundaries must be atomistic. So objects are made of non-atomistic extended matter, bounded by atomistic, but unextended boundaries, as if all objects were covered by a kind of cosmic talcum powder in order to allow that they touch one another in the required sense. Apparently Francisco Suarez and Franz Brentano held this view. (ZIMMERMAN 1996, p. 158)

Second, we might hold that there are two types of mereological object in the world, one type of which is atomistic, and the other anatomistic. For example, we might think that material objects are made of atoms (perhaps finitely many atoms), while substantival space is atomless gunk. Or vice versa.

All of these views, atomism, anatomism, and the Suarez/Brentano hybrid view seem to me not clearly false, but at best metaphysical speculations that are outside the scope of mereology itself. This fact is reflected in classical mereology in that none of the formulae Atom, Anatom, Hybrid, or their negations are theorems of classical mereology. Classicalism is neutral on all of them.

3.5.2   More on Atomism

Of the three positions about partition discussed in the previous section, I look with most favour on atomism. It seems to me that there is a good argument for atomism on empirical grounds.

The argument is from the premises that 1) we have discovered that all matter has atomic parts, namely, quarks and leptons, and 2) everything that exists is matter. If both these premises are granted, clearly it follows that everything has atomic parts.

The justification of these premises unfortunately goes a little beyond the scope of the present work. (2) is a form of **materialism**, though, unlike many formulations of materialism, it also implies relationalism about space-time. (1) should follow from **scientific realism**, construed in a certain way, together with certain discoveries about the nature of matter, especially those of quantum chromodynamics.[5]

While the defence of materialism, the details of physical science, and scientific realism *per se* are definitely beyond scope here, I will say a little about how the type of scientific realism needed by by argument differs from some related ways of formulating scientific realism.

I think of scientific realism as the doctrine that current total science is nearly right about the ontology of the world. There are, to a close approximation, tokens of the types of thing spoken of in current total science, and nothing else.

- It is an *ontological* formulation of realism. Following Devitt (1984), I take realism to be an issue about what there is, rather than say, whether certain sentences have truth conditions, or about the interpretation of science.

- Scientific realism is tied to *current science*, rather than an ideally completed science. Realism about ideal science is a toothless doctrine, since unless we also believe scientific realism in my sense, we have no way of knowing what ideal science will be like.

- Scientific realism *excludes* things, as well as including them: there is an "and nothing else" clause. Again, this is to ensure that the resulting doctrine has teeth: it ought to be the case that believing scientific

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[5]For accessible summaries, see (DODD 1984), (FRITZSCH 1984), and (TREFIL 1980).

realism is incompatible with interactionist dualism, owing to problems about the conservation of energy. But if scientific realism cannot ever rule out the existence of something, then this would be impossible.

- Scientific realism is tied to *total science*, rather than, say, the most fundamental, or most reductive, parts of physical science. This is partly because I don't wish to foreclose against there being some non-reducible high level science. More importantly however, in the light about the exclusivity of my formulation, fundamental physics doesn't say much about chairs, persons, nation states, or moral values. Science should be taken to include social science, naturalistic metaphysics, and our folk understanding of the world (where not superceded by more developed sciences).

Scientific realism taken in this form entails that atomism is true of material things. This issue will be taken up further in section 5.2.2.

Notice that, given my mereological realism, I could abandon my endorsement of classical mereology, in favour of a mereological system in which Atom follows as a theorem. An important reason for not doing this is cut off from me. It is commonly said that atomism is a "substantive" mereological or metaphysical doctrine, which makes it inappropriate to include as part of a mereological system. This idea is associated with mereological analyticism, according to which the theorems of mereology should only be those formulae that come out analytic when translated into ordinary language. However, I deny mereological analyticism, for the reasons given in section 3.2.

Nevertheless, it does seem to me that atomism is a lot closer to the fringes of our web of belief than principles such as WSP and Trans, which perhaps do come close to being analytic; or even GSP and PPP. For that reason, I have not included Atom among the axioms of the mereological system I propose to use, even though such a system would be perfectly adequate by my lights.

3.5.3   Arbitrary Spatio-temporal Parts

Peter van Inwagen has described the Doctrine of Arbitrary Undetached Parts (DAUP) as the view that

> [f]or every material object M, if R is the region of space occupied by
> M at time *t*, and if sub-R is *any* occupiable sub-region of R *whatever*,

> there exists a material object that occupies the region sub-R at *t*.
> (VAN INWAGEN 1981, p. 123)

there is an obvious generalisation of this claim to include not just spatial parts, but spatio-temporal parts. We might call this doctrine DASTP:

> For every material object M, if R is the region of space-time occupied by M, and if sub-R is *any* occupiable sub-region of R *whatever*, there exists a material object that occupies the region sub-R.

DAUP and DASTP both offer principles about the parts of objects, but unlike Atom, Anatom, and Hybrid, they are not mereological principles, because they make mention of spatial predicates such as "is region of space[-time]", "occupies", and "is a subregion of". "Subregion" could perhaps be given a mereological reading (and in fact, I think it is a very plausible reading) as "part", but "occupies" and "is a region of space[-time]" cannot. I call principles of this kind "**quasi-mereological principles**", by contrast with **mereological principles** such as WSP, GSP, and PPP.

DAUP and DASTP doen't actually tell us anything about what sorts of parts material things have in the absence of a theory about what sorts of subregions regions of space-time have. If we accept the reading of "is a subregion of" as "is a part of", then what they say is that the mereological structure of material things is isomorphic at any given time to the mereological structure of occupied space at that time (DAUP), or that the mereological structure of material things is isomorphic to the mereological structure of occupied space-time (DASTP). In the absense of a theory about what the mereological structure of space-time is, DAUP and DASTP say very little.

Van Inwagen's argument

Even so, van Inwagen thinks he can argue against DAUP and DASTP on *a priori* grounds. The argument is a reductio that turns on a move that van Inwagen supposes to be licensed by DAUP: suppose a person has a foot, then there is something which is the object occupying the intersection of the region of space occupied by the person, and the region of space that is the complement of that occupied by the foot. Call the person Dion, and the

foot Foot, then there is such an object as Dion minus his foot (according to DAUP).

This is the only role DAUP plays in van Inwagen's reductio. Interestingly, however, though DAUP cannot be stated in merelogical language, we can state the principle which licenses this inference in mereological language. It is the Remainder Principle, or RP: (SIMONS 1987, p. 88)

> (Remainder Principle) For any object O, having a proper part P, there is an object $O - P$ which is the mereological fusion of all parts of O that do not overlap P.

Or, in the formal language of mereology:

$$\text{RP} \quad \sim x < y \supset (\forall z)(\exists w)(w < z \equiv w < x \wedge w \wr y)$$

In effect, van Inwagen takes himself to have an argument against a principle like RP. (Elsewhere, he has denied RP explicitly (VAN INWAGEN 1990B, pp. 52–55)). Let us suppose that argument is sound. If so, then van Inwagen has refuted mereological classicalism, because RP is a theorem of classical mereology. But does RP follow from DAUP? When van Inwagen makes the move from the existence of Dion and Foot to the existence of Dion-Foot, he assumes that spatial regions are sets of spatial points. He says "By DAUP there is an object that occupies just that region of space that is the set-theoretic difference between the region occupied by O and the region occupied by P." (VAN INWAGEN 1981, pp. 124–125)

This way of thinking about space entails that the mereological structure of space (allowing that the sub-region relation is the part-whole relation) is classical (and atomistic, for that matter). The non-empty sets of space-time points satisfy the axioms of classical mereology, when < is interpreted as set-inclusion. If we thought that the mereology of space itself was non-classical, then the set-theoretic treatment of space that van Inwagen employs would be inappropriate.

So, van Inwagen's argument is a bit like this:

2 The mereological structure of material things is like that of space (For reductio).

3 The mereology of space is classical. (Suppressed premise).

4 RP holds for material things (from 2 and 3).

5 But, RP leads to absurdity!

6 (Therefore) The mereological structure of material things is unlike that of space.

Once the argument is stated in this way, it is very hard to see why someone who accepted premise 5 (which I have accepted only for the sake of argument here) would prefer to reject 2 rather than 3.

One possible reason might have to do with reasons for rejecting RP (i.e. accepting premise 5). Van Inwagen's reasons have to do with the possibility of objects persisting through the loss of parts (which I will discuss later, see section 5.4.1). Now, we don't normally think of the ability to persist through change in parts as an essential feature of space. So van Inwagen's reasons for rejecting RP mightn't seem to be an appealing reason for rejecting 3. But in conjunction with the argument above, they should be — at least if we are prepared to hang onto DAUP.

This is all by way of saying why I reject van Inwagen's *a priori* argument against DAUP and DASTP. But I think its conclusion is true.

Why I reject DAUP and DASTP

It follows from the type of atomism I endorsed in section 3.5.2 that there are only finitely many atoms. On the other hand, I don't wish to beg the question against the continuity of space; or indeed against the hypothesis that space is discrete, but infinitely divisible. Certainly, space might be divisible to a greater extent than matter. So I reject DAUP. This argument will get more attention in section 5.2.2.

3.5.4   Mereological Pluralism

Some metaphysicians are troubled by the type of reasoning I have given against DAUP that, but still want to hold that DAUP is something like a conceptual truth. This leads them to hold that there are, in fact, multiple

part-whole relations (or, perhaps, multiple concepts of a part-whole relations) for some of which DAUP is true, and others of which it is not.

This view seems to be due to Denis Robinson:

> [T]he use I propose of this notion [part-whole] requires moving from the idea of physical to the idea of purely conceptual partition. But common sense finds no difficulty with the spatial analogue of this shift (as when we advance from talk of 'the parts of the watch' to 'the part of Africa north of the equator'). (ROBINSON 1982, p. 322)

Ned Markosian makes the connection with DAUP explicit. He considers an argument for DAUP from the premises

(i) If any object has some extension, then it has two halves.

(ii) If any object has two halves, then it has at least two proper parts.

Let us call this the **halves argument**. Markosian says:

> [I]t is apparent that anything with some extension will have *conceptual parts*, even if it doesn't have *metaphysical parts*. That is, premise (i) seems true because we understand 'half' to mean *conceptual half*. But premise (i) does not seem so obviously true if we take it to be talking about *metaphysical parts*; for it is not obviously true that every object with some extension must have metaphysical parts. Meanwhile, premise (ii) seems clearly true when we understand 'half to mean *metaphysical half*, but not when we understand 'half' to mean *conceptual half*; for it is not obviously true that any object with conceptual halves must have at least two proper (metaphysical) parts. And of course if we combine the obviously true readings of the premises into a single argument, then that argument will be invalid. (MARKOSIAN 1998, p. 224)

Robinson accepts DAUP, while Markosian denies it, but they both agree on why it is appealing. There is a "conceptual" sense of "part", they say, about which it is natural to believe DAUP; and a "physical" or "metaphysical"

sense, about which it is not natural to believe DAUP. They differ on which they take to be the sense of "part" which is of interest to metaphysicians.

They also agree that certain arguments about DAUP go wrong because of equivocation: Robinson thinks that arguments (such as mine) against DAUP equivocate when I move from empirical discoveries of science (about "physical parts" on his view) to the rejection of DAUP (about "conceptual parts" on his view). Markosian thinks that arguments such as the halves argument equivocate in moving from premises like (i) and (ii) (true, according to him, if "part" and "halves" are understood "conceptually") to DAUP (false, according to him, because it should be understood "metaphysically").

I call this view "**mereological pluralism**".

Against mereological pluralism

There are two things wrong with mereological pluralism.

The first problem is that the concept of a part is a very general univocal one. The reason for thinking this is that we can introduce it in all sorts of new contexts, without having to make up a new concept. When Locke says that the idea of the power of motion is a part of the idea of a man, you know what he means without his having to tell you what he means by "part". When David Lewis says that subsets are parts of supersets, or when Plato considers (in the *Parmenides*) whether or not the forms have parts, again, we know what is going on. I think that this is evidence that in these cases, a concept we are already familiar with — the concept simply of a part — is being used. So it seems to me that "part" is not ambiguous in the sense required.

The second problem concerns mereological realism. If the mark of "conceptual parthood" is that it is the concept that makes arguments such as the halves argument sound, then it seems to be a good question whether such a concept is well-suited to fit the world. And that is just the question of whether the *metaphysical parts* satisfy all that's alleged to be true of the conceptual parts. If DAUP is true of conceptual parts, but not of metaphysical parts, then they don't — so, the concept of a conceptual part is defective and should be discarded or revised.

To make this clearer, an analogy might be in order. Arguments like the halves argument seem to me to be a bit like the ontological argument for the existence of God. Anselm and Descartes might well have had a concept of God such that they could not logically escape the conclusion that God exists.

Similarly, Robinson and Markosian seem to be alleging that the concept of a conceptual part is such that one cannot logically escape the conclusion that extended objects have distinct conceptual parts. In both such cases, it's still a perfectly good question to ask about whether the world matches the concept.

The halves argument

Since I have introduced the halves argument for DAUP in discussing mereological pluralism, I should say something about what I think is wrong with it, since I have cut myself off from Markosian's reasons for thinking that it is invalid.

I think that the argument does not equivocate at all. Rather it is unsound because (i) is false. We are apt to be fooled into thinking (i) is true because of observations like this:

(i′) If any object has some extension then it has a left half and a right half.[6]

(i′) is true, but (i) does not follow from it. For (i) adds the claim that the two halves are not numerically identical. In my view, the relationship between the left and the right half of some extended object before me is like the more famous relationship between the morning star and the evening star. Just as, in a certain sense, it is an open question — not to be decided by mere analysis — whether the morning star and the evening star are the same object, it is an open question whether the two halves of any extended thing are, in fact, one and the same.

Even the hypothesis of absolute monism — the view that there is only one thing — is an open question in this sense. It is possible, I think, that the world might be superficially just as it is, and there be only one thing, just as the British idealists believed. Of course, they believed falsely, but it was not for want of *a priori* reflection. This provides good evidence that absolute monism is not to be refuted on *a priori* or analytic grounds alone.

There is a further argument to made here. The morning star and the evening star are very similar. In fact, given that they are one and the same, they are duplicates. The same goes for the two halves of, say, a perfectly homogeneous

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[6] "Left" and "right" here mean left or right with respect to the observer who is saying "If any object..."

sphere. But many of the things that there appear to be are intrinsically very different: could a strawberry and a potato turn out to be identical? To make the argument a bit more explicit, suppose all strawberries are sweet, while all potatoes are not. If there is anything that is both a strawberry and a potato, as the Absolute is supposed to be, it would have to be both sweet and not sweet. So it seems we can deduce a contradiction from absolute monism together with some very ordinary empirical observations, if not quite on *a priori* grounds.

I will discuss this **problem of difference** (so-called because the crucial premise is that there are things that are qualitatively different from each other) at further length later (see section 5.2.4). For now, I just want to make it clear that it is distinct from the halves argument, for that argument would have whatever force it has even if the universe were completely homogeneous, provided it were extended.

Part II

Theories of Persistence

Chapter 4

Perdurantism

4.1 The Theory

The simplest and most orthodox theory of persistence is what is often called
the theory of temporal parts, space-time worms, or perduring objects. I will
call this theory "**perdurantism**". According to perdurantism, every persist-
ing object is located at multiple times, having a distinct proper part located
at each of every time at which the persisting object is located. Objects that
persist in this way are said to "perdure". Perdurantism holds that to persist
is to perdure.

By "proper part" of an object, I mean a part that is not identical to the
object of which it is said to be a part. It follows that perduring objects
have many many parts, more than we would perhaps have thought, prior to
accepting the theory. Parts of an object that are located at some but not all
of the places at which the object is located are that object's **spatial parts**.
Parts of an object that are located at some but not all of the times at which
the object is located are that object's **temporal parts**. For terminological
nicety, we'll say that every object is both a temporal and spatial part of
itself. Finally, temporal parts of an object which are located in all and only
the same spatial locations as the object itself is, during the lifetime of that
temporal part, are **cross-sectional temporal parts**.

In this usage, every object in time is a temporal part (in fact, a cross-sectional
temporal part) of itself. So it is a triviality that if there are objects in time
(as we will say, "temporal objects") then there are temporal parts. It is not
trivial, on the other hand, that if there are persisting objects, then there are

proper temporal parts. This non-trivial claim is one of the implications of perdurantism. However, not everyone who believes in proper temporal parts is a perdurantist. It's possible to believe in proper temporal parts without believing that having such parts is necessary for persistence.

In order to state some of the arguments given for perdurantism, I will sometimes have to use the term "endure" to mean (at this stage) persisting without perduring. Many of the arguments for perdurantism take the form of *reductio* arguments against endurance. (For more on endurance, see chapter 5.)

4.2 Arguments

There are three main types of argument for perdurantism: arguments from an analogy between space and time — particularly between extension in space, and persistence through time (section 4.2.1); arguments concerning the possibility of intrinsic change (section 4.2.2); and an argument from the possibility of a scenario very like perdurance — the sucessive creation and annihilation argument (section 4.2.3).

4.2.1   The Analogy with Space

It is very often claimed that our concept of persistence through time is importantly similar, or analogous to, our concept of extension through space. This idea received an early and influential mention in Richard Taylor's classic collection of analogies between space and time:

> [T]he concept of length or extension has a place in both [spatial and temporal] contexts, though this is easily overlooked. Things can be spatially long or short, but so too they can have a long or brief duration, i. e., be temporally long or short.... The notion of length in turn leads to that of *parts*, both spatial and temporal. (Taylor 1964, p. 382)

The claim that there is such an analogy is often identified with perdurantism, for example by Theodore Sider:

> Persistence through time is much like extension through space. A road has spatial parts in the subregions of the region of space it occupies; likewise, an object that exists in time has temporal parts in the various subregions of the total region it occupies.
> (SIDER 1997, p. 197)

Or with 'four-dimensionalism': Mark Heller writes of

> minimal four-dimensionalism — the view that persisting objects extend over time in the same way they extend over space
> (HELLER 1993, p. 49)

Peter van Inwagen of

> "four-dimensionalism," according to which persisting objects are extended not only in the three spatial dimensions, but also in a fourth, temporal, dimension, and persist simply by being temporally extended.   (VAN INWAGEN 1990a, p. 245)

Strictly speaking, however, this analogy is not equivalent to perdurantism. Perdurantism is the doctrine that objects persist by having distinct temporal parts located at each time at which the persisting object is located. The analogy in question is the doctrine that persistence, whatever it may be, is the temporal case of extension.

The analogy does however suggest an argument for perdurantism. Given that objects *do* extend by having distinct spatial parts located at each place at which the extended object is located, if the analogy is correct, objects should persist by perduring.

Thus,

7 Persisting objects extend over time in the same way they extend over space.

8 All extended objects extend in virtue of distinct parts at distinct places.

9 *Therefore,* All persisting objects persist in virtue of having distinct parts at distinct times.

Premise 7 is simple the analogy between persistence and extension that we are discussing. Premise 8 is the observation that macroscopic objects typically do have spatial parts: I fill this bit of space to my left by having my left arm there, and this distinct bit of space, to my right, by having a distinct part, my right arm, there. Each arm extends through its region of space by having many distinct cells as parts, each filling a distinct, smaller region of space, and so on down to the subatomic level. Hence, 9, those objects fill up time just the same way — by perduring, that is.

Spatial analogies and special relativity

The quoted versions of the analogy between persistence and extension given above appeal to common sense for the analogy between these concepts. Such a reading of common sense is controversial. But another important source for the analogy is physics. This point has been urged by J.J.C. Smart:

> [E]ven common sense can be construed as having an underlying four-dimensional view of the world,... But if I am wrong about this then common sense should yield to science, because the notion of space-time is absolutely central to the special and general theories of relativity. (SMART 1989, p. 21)

(I will restrict my discussion here to special relativity (as does Smart). General relativity complicates the presentation of the following argument without affecting the conclusions.)

According to special relativity (SR), the world is a four-dimensional non-Euclidean manifold called a Minkowski space. These four dimensions are not the familiar three spatial dimensions plus a temporal one. No dimension is any more temporal than any other (except relative to objects in the manifold). In Minkowski space, material objects are represented by curves called world lines.

Rather than having a distinction between time and space, SR has a distinction between time-like separation and space-like seperation. This distinction is connected with the famous speed limit of SR — c, the speed of light, which

cannot be exceeded by any moving object. Imagine a point, ϕ, momentarily emitting light in all directions. The light would form an expanding sphere, speeding away from ϕ, the point of origin, at its center. In Minkowski space, the surface of this sphere forms a hypercone, which is called ϕ's light cone. Points inside the light cone are time-like seperated from ϕ, and those outside are space-like seperated from ϕ.

The point of all this is that the distinction between time and space in SR is a matter of the geometrical relationships between points in space-time, and not a matter of how material objects occupy those points. A persisting object intersects at least two points time-like seperated from each other. An extended object intersects two points space-like seperated from each other. There is an obvious analogy here.

4.2.2   The Problem of Change

The problem of change comes about because of a tension between two things we would like to believe about change. We'd like to believe, on the one hand, that a changing thing must be the same thing before and after the change (otherwise no change has occurred, merely a difference between two things). On the other hand, we'd like to believe that a changing thing is qualitatively different after the change from the way it was before (otherwise no change has occured, because our putatively changing thing has stayed just the way it was). These two intuitive necessary conditions for change are, however, hardly compatible.

For example, suppose that a certain thing, a poker, say, is hot at one time, t_1, and later, at t_2, cold. And suppose that we have one standard of heat and coldness in mind here, so that it would be contradictory to say of one thing that it is both hot and cold.

The problem is that it's supposed to be the *very same* poker at t_1 and at t_2. No-one has come along and switched pokers on us. But yet this one object is supposed to be both hot and cold. If I told you that I had a poker that was both hot and cold, I would be contradicting myself. We know that there are no such pokers, nor could there be. But if we believe that things can change, then we must believe that one thing can be both hot (at one time) and cold (at another), and we can say so without fear of contradiction.

The perdurantist solution is simple: the incompatible properties do not belong to the same thing, the poker, rather they belong to distinct temporal

parts of the poker. When we say that the poker is hot at t_1, all that's needed to make what we say true is that the poker have a hot part at t_1. This is not incompatible with the poker's having a cold part at t_2, provided they are not the same parts.

The semantic problem of change

Here is another way of glossing the problem. When things persist, they are located at multiple times; and when they change, they are different ways at some of those times. Take a poker cooling down, for example: it makes sense to say of the poker, before it changes, that it was one way, and after it changes, that it is another way. So, we might say "the poker is hot at t_1" and "the poker is cold at t_2". It's an interesting question what the logical forms of these sentences are. In particular, we need an account of those logical forms that doesn't make the two statements "the poker is hot at t_1" and "the poker is cold at t_2" contradict one another.

This is what E.J. Lowe calls the semantic problem of change:

> The *semantic* problem of intrinsic change is the problem of specifying the logical form of sentences ascribing temporary intrinsic properties to persisting objects, in such a way that we do not run into contradiction in describing such an object (Lowe 1988, pp. 72–73)

The problem is then, how do we analyse a statement of the form displayed below?

10 a is F at t

The point about avoiding contradiction is that a simple minded analysis such as

11 a is F and a is at t

won't work, because we want to assert pairs of propositions like "the poker is hot at t_1" and "the poker is cold at t_2". On analysis 11, these come out contradicting each other, and can't consistently be asserted together.

Lowe goes on to offers three alternative analyses, by binding the modifier "at
t" to each, in turn, of the remaining parts of the English schema "a is F at
t":

   12 a-at-t is F

   13 a is F-at-t

   14 a is-at-t F

These analyses are each supposed to correspond to a possible solution to the
problem of change. 12 allegedly corresponds to the perdurantist solution un-
der consideration in this chapter; 13 to endurantism with temporally indexed
properties and 14 to adverbialism (both of which will be discussed in chapter
5).

We might add a fourth possible analysis that Lowe does not consider:

   15 $\diamond_t$ (a is F)

in this analysis, "at t" modifies a sentential operator on the entire sentence.
This analysis is intended to correspond to presentist solutions to the problem
of change, which we will meet in chapter 6.

Lowe does not intend his version of the problem of change as an argument for
perdurantism — quite the reverse, he is a committed endurantist, and rejects
perdurantism. He does however intend this formulation of the argument to be
a clarification of the problem of change as it has been used by perdurantists
(especially by Lewis). Lowe's claim is that we should think of the problem
of change as a question of which of 12–15 offers the best explanation of the
semantics of 10.

We cannot well assess the soundness or cogency of this argument at this
stage, because we have not presented all of the theories of persistence that
correspond to the different analyses, and we are being asked to choose which
of these is the best. For the moment, note that perdurantism seems to have
a solution to the semantic problem of change. We will return to this version
of the problem later.

Also note that this version of the problem of change makes the crucial ques-
tion a matter of the semantic analysis of ordinary language sentences —
sentences of the form of 10.

The problem of temporary intrinsics

Another influential way of formulating the problem of change concerns the possibility of **temporary properties** (especially intrinsic properties). A much-quoted section of David Lewis's *On the Plurality of Worlds* states the argument nicely:

> The principal and decisive objection against endurance, as an account of the persistence of ordinary things such as people or puddles, is the problem of temporary intrinsics. Persisting things change their intrinsic properties. For instance shape: when I sit, I have a bent shape; when I stand, I have a straightened shape. Both shapes are temporary intrinsic properties; I have them only some of the time. How is such change possible? I know of only three solutions.

> First solution: contrary to what we might think, shapes are not gtenuine intrinsic properties. They are disguised relations, which an enduring thingmay bear to times... And likewise for all other seeming temporary intrinsics; all of them must be reinterpreted as relations that something with an absolutely unchanging intrinsic nature bears to different times... This is simply incredible if we are speaking of the persistence of ordinary things... If we know what shape is, we know that it is a property, not a relation.

> Second solution: the only intrinsic properties of a thing are those it has at the present moment. Other times are like false stories; they are abstract representations, composed out of the materials of the present, which represent or misrepresent the way things are... This is a solution that rejects endurance; because it rejects persistence altogether...

> Third solution: the different shapes, and the different temporary intrinsics generally, belong to different things. Endurance is to be rejected in favour of perdurance. We perdure; we are made up of temporal parts, and out temporary intrinsics are properties of these parts, wherein they differ one from another. There is no problem at all about how different things can differ in their intrinsic properties. (LEWIS 1986, p. 203–204)

A very similar formulation puts the problem in terms of intrinsic duplication rather than intrinsic properties. Two things are duplicates if and only if they are intrinsically just alike (see section 2.1.4). Two identical twins are near duplicates, but not quite. Probably the only uncontested instance of genuine duplication that we will ever find is of one thing with itself. For everything is just like itself, nothing can ever be unlike itself.

But it is precisely that one uncontested and uncontestable case that creates problems for us in the case of change. It seems to be essential to intrinsic change, change in temperature for example (or shape, or mass), that the poker of t_2 *not* be a duplicate of the poker of t_1. If the poker of t_2 was a duplicate of the poker of t_1, then one way in which it must duplicate it is the way of temperature. But, by hypothesis, that is not the case. Hence the poker of t_1 is not a duplicate of the poker of t_2. Hence, since everything must be a duplicate of itself, the poker of t_1 is not the same poker as that of t_2.

To summarise:

16 The poker of t_1 (P-of-t_1) is hot and the poker of t_2 (P-of-t_2) is cold.

17 *hence,* P-of-t_1 is not a duplicate of P-of-t_2

18 *hence,* P-of-t_1 is not identical to P-of-t_2

19 *hence,* The poker has not endured from t_1 to t_2

20 *hence,* The poker has perdured.

4.2.3   The Sucessive Creation and Annihilation Argument

The argument I am about to describe originates with an example given by D.M. Armstrong:

> Suppose that there are two very powerful deities, each able to annihilate and create, who operate quite independently of each other. The first deity decides to annihilate Richard Taylor and does so that place p, time t. The second deity has not been watching what was happening. He decides to create a man at p and t. By a coincidence that can only be described as cosmic, he decides to give this man

> exactly the same physical and mental characteristics that Taylor had
> at p and t. Life goes on as usual.   (ARMSTRONG 1980B, p. 76)

Armstrong believed that in this case, the two Richard Taylors, Taylor$_1$ and
Taylor$_2$ were just like two temporal parts of the actual Richard Taylor (except
for the fact that Taylor$_1$ and Taylor$_2$ are not causally related).

This example, if coherent, shows that there is nothing suspect about the
concept of a temporal part, as has often been alleged by non-perdurantists.
Anyone who accepts the metaphysical possibility of the two deities of Arm-
strong's example should accept the metaphysical possibility of the object we
take to be Richard Taylor's turning out to have the temporal proper parts
Taylor$_1$ and Taylor$_2$; and, therefore, the metaphysical possibility of temporal
proper parts.

That is not to say that Richard Taylor actually has temporal parts, or that
to persist is to perdure. In fact, by my definition, Armstrong is not a perdu-
rantist, because he holds that perduring alone is not sufficient for persisting
(see section 4.4.1).

But there is a way of beefing up Armstrong's argument so that it becomes a
way of arguing for full-blown perdurantism. This beefed up version has been
given by David Lewis:

> First: it is possible that a person-stage might exist. Suppose it to
> appear out of thin air and then vanish again. Never mind whether it
> is a stage *of* any person...

> Second: it is possible that two person-stages might exist in sucession,
> one right after the other but without overlap. Further, the qualities
> and location of the second at its appearance might exactly match
> those of the second at its disappearance...

> Third: extending the previous point, it is possible that there might
> also be a world of stages that is exactly like our own world in its
> point-by-point distribution of intrinsic local qualities over space and
> time.

> Fourth: further, such a world of stages would also be exactly like
> our own in its causal relations between local matters of particular
> fact. For nothing but the distribution of local qualities constrains
> the pattern of causal relations...

> Fifth: then such a world of stages would be exactly like our own
> simpliciter. There are no features of our world except those that
> supervene on the distribution of local qualities and their causal rela-
> tions.
>
> Sixth: then our own world is a world of stages.
> (Lewis 1983c, p. 76–77)

Lewis goes on to say that of course, stages are not suited to be persons,
because they do not persist long enough. So we should think of persons as
composite objects made up of stages. And of course similar arguments will
go through for non-persons as well.

This argument has a number of contentious premises that it is worth teasing
out. The premises represented by the first and second steps are the point
made by Armstrong's argument — that anyone who believes that it is meta-
physically possible for objects to be abruptly created and destroyed should
believe that it is metaphysically possible that some object have temporal
parts.

As Lewis says, the third point merely extends this idea. The third point
shows merely that it is metaphysically possible that there be a perdurance
world, and that such a world could be much like our own. This is an inter-
esting result, but to establish perdurantism, Lewis also needs to show that
this world is actual.

The fourth and fifth steps are supposed to bridge that gap. But here Lewis
is forced to appeal to more controversial metaphysical principles: in the
fourth step, a Humean-like constraint on the facts of causation, and in the
fifth step, a version of what he has called "Humean Supervenience". These
doctrines about causation and supervenience however, are often held to be
refuted *precisely by* the result Lewis aims to get — that there is no difference
between the actual world, and a world in which Richard Taylor suffers the
malicious intervention of the deities. (For more, see section 4.4.1).

4.3   Problems and Misunderstandings

I consider three problems for perdurantism. The first is not really a problem,
but more of a clarification — perdurantism is often confused with another
theory of persistence that is really more closely related to presentism (section

4.3.1). This theory itself is discussed later, in section 6.5.2. The second is a problem about the strange scattered objects that a perdurantist who also accepts classical mereology is committed to (section 4.3.2). The third problem is the 'problem of the many' — the problem that the perdurantist seems committed to many more ordinary objects than we ordinarily take there to be (section 4.3.3).

4.3.1   Funny identity

Perdurantism is sometimes characterised as "the relational view of identity"; or described as the doctrine that objects are not "strictly identical" over time, but only "loosely identical". These characterisations are then followed up by table-thumping in favour of strict identity: we should not care about what will happen to our future selves if they are not really identical to us! Doesn't the "loose identity" between stages violate Leibniz's law of indiscernability of identicals? And so on....

While these sorts of objections have their place, they are not objections to perdurantism. These are all objections to any view which rejects the idea that persisting things are multiply located in time. Even perdurantists sometimes mischaracterise their views in this way[1], which perhaps accounts for the frequency with which these types of objection are heard. But perdurantism, as I understand it, accepts that persisting things are multiply located. The relationship between myself of now, and myself of 1980 is strict identity according to perdurantism — I am am just as much located in 1980 as I am located now. Nor is there any problem about why I care for the welfare of my future self — we are just as identical as the objector demands.

These are not problems for perdurantism, but for a related theory, stage theory, which will be discussed in section 6.5.2. The ontology of stage theory is very similar to that of perdurantism, but it denies that persisting things are multiply located.

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[1] Armstrong, for example, writes of a "relational view [of identity through time]" (ARMSTRONG 1980B, p. 67), when he clearly means perdurantism — or rather his causal variant of perdurantism.

4.3.2 Strange objects

A common objection to the belief in temporal parts when combined with mereological classicalism (see section 3.1) is that on this view there would be many more ordinary objects than we ordinarily suppose. If persons are nothing more than mereological fusions of person-stages, and fusion is unrestricted (as classicalism would have it), then is there not a person who consists of the person stages of Richard Taylor up until 1980, and the stages of David Armstrong thereafter?

This is not a difficult problem to solve, but it is instructive to see it done — in part because there are two ways of solving it. The most mainstream way, which I will discuss here, consists in pointing out that perdurantism offers a theory of persistence, but not a theory of personhood. Yes, there is something which is the mereological fusion of the stages of Richard Taylor up until 1980, and the stages of David Armstrong thereafter; but it is not a person, and no-one need mistake it for one.

This way of treating the problem is in the spirit of Locke's dictum that "to find wherein *personal identity* consists, we must consider what person stands for" (LOCKE 1976, II.xxvii.9). The problem about the Taylor-Armstrong fusion can be phrased as a problem about personal identity: why is it that we think of today's Taylor as a continuation of the author of *Metaphysics*, and not of the author of *A Materialist Theory of the Mind*? Once we accept the ontology of temporal parts and classical mereology, there is no question that there is something whose parts wrote both books — no surprise here, as the universe is such a thing — but it remains true that there is no person who wrote both books, or who wrote *Materialist Theory* and is now called "Taylor".

The alternative solution holds that not only is there no person who wrote *Materialist Theory* and is now called "Taylor", but that nothing, person or otherwise, persisted from writing *Materialist Theory* to being called "Taylor". That is a slightly rough way of putting it, but I think it bears out the intuition that is in play. We might cash out talk of "persisting from *a* to *b*" in terms of being a thing that persists, does *a*, and does *b*. So the solution in question is that not only is there no person who who wrote *Materialist Theory* and is now called "Taylor", but no *persisting object*. This view is not strictly compatible with perdurantism on my definition, but is closely related to it, and will be further discussed in section 4.4.1

4.3.3   The Problem of the Many

A followup to the problem of strange objects discussed above bears further
attention. Let us accept the mainstream answer to the problem of strange
objects, and shift the lump under the rug away from persistence, and over
to personhood. It is clear enough that the strange Taylor-Armstrong fusion
is not a person, but there are many other more 'persony' ways of putting
together the stages — which one is Taylor?

Suppose that the time t_b is the instant of Taylor's birth, and t_d the instant
of his death. The mereological fusion of all of the Taylor stages, including
those stages located at t_b and t_d is one object, and the fusion of all the Taylor
stages excluding that located at t_d is another. Which one is Taylor? Which
one is the author of *Metaphysics*?

It won't do any good to say that Taylor, the one who starts at precisely t_b
and ends at precisely t_d, is the only person, because clipping an instant off
the end of someone's life doesn't make them not a person. If Taylor had been
born an only instant later than he actually was, or were he to die an instant
later than than he actually will, he would not be any less a person.

Another way of putting this problem is to point out that birth and death
take time, and are not instantaneous. In fact it is a vague matter exactly
which time marks the start of any given person, and which the finish; and
that is the point of the problem. Persons have vague boundaries; there are
an infinite number of instants at which Taylor might reasonably be said to
have been born, and another infinite number of instants at which it may be
reasonably said that he will die; and there is a corresponding infinite number
of ways of putting together persons out of Taylor stages that are born when
Taylor is born and die when he dies.

So it seems that there are an infinite number of overlapping persons who
deserve to be called Taylor. But this is absurd — we had better go back and
find a premise to reject. Insofar as this is an argument against perdurantism,
it may be the ontology of temporal parts — of Taylor stages — that is to be
rejected; and with them goes perdurantism.

Solutions

There are a number of ways of dealing with this problem, and it would go
beyond the scope of the present work to discuss them all. (For an opinion-

ated survey, see (LEWIS 1993)). I will focus on a common feature of some solutions, which Theodore Sider has called attention to.

Sider suggests that many of the sortals whose objects seem to have vague boundaries (sortals such as "person", in our example) express **maximal properties**, where

> [a] property, *F*, is *maximal* iff, roughly, large parts of an *F* are not themselves *F*s.
>
> ...Consider, for example, the mereological difference between a house and one of its windows. Linguistic intuition assures us that this entity, call it House-minus, is not a house. I own a single house, not thousands. House-minus is a very large part of a thing that *is* a house, and so it itself is not a house. *Being a house* is a maximal property.   (SIDER 2001)

Similarly, we might think that *being a person* is a maximal property. Suppose Taylor is a person, and that *being a person* is a maximal property. Since Taylor minus his time slice at t_d — Taylor-minus for short — is a large part of Taylor, Taylor-minus is not a person.

This solves our problem to the extent that it explains why there is only one person called Taylor. I gave a reason above for believing that Taylor-minus is a person: "If Taylor had been born only an instant later than he actually was, or were he to die an instant later than than he actually will, he would not be any less a person." But if *being a person* is a maximal property, it does not follow from this that Taylor-minus is not a person. Taylor-minus *would have been* a person, were he not a large part of the person Taylor.

There is still one part of the problem left to solve, however. Even supposing we accept that Taylor the person is the *maximal* Taylor-like object, which one is the maximal one, given that persons have vague boundaries? What is it about t_b amd t_d that makes them the boundaries of Taylor, and the instant before t_b, and the instant after t_d not the boundaries?

This is an ordinary problem of vagueness, and can be solved in familiar ways. For example, we might take an epistemic-flavoured solution: there is a unknowable fact of the matter of what Taylor's boundaries are. Even though we don't know where they are, we do know they are somewhere, and that the fusions of Taylor slices that don't have those boundaries are not persons (because of maximality).

Or, we might take a supervaluation-flavoured solution (Lewis 1993, p. 171): there is no fact of the matter which fusion of Taylor-slices is Taylor, or which of them are persons. We can correctly use "Taylor' to pick one of an infinite number of fusions, and we can correctly use "person" to say of any of those fusions that it is a person. However we use "Taylor" and "person", however, we can only use them in such a way that only one person wrote *Metaphysics*. On all precisifications of "Taylor" and "person", Taylor minus or plus only a single time-slice is not a person.

4.4   Variants

I describe two variants on perdurantism. The first are those theories that consider perduring to be a necessary, but not sufficient condition of persisting, which I call "strong perdurantism" (section 4.4.1). The second concerns the issue of whether a perdurantist should believe that there are instantaneous temporal parts (section 4.4.2).

4.4.1   Strong Perdurantism

Perdurantism, as I have defined it, takes perduring to be necessary and sufficient for persisting: to persist is to perdure. In chapter 5 I consider theories of persistence that drop the necessary condition (and perhaps also the sufficient one). But what about theories that drop the sufficient condition while retaining the necessary one? Such a theory of persistence would hold that, while everything that persists perdures, not everything that perdures persists.

I call this position **"strong perdurantism"**. The strong perdurantist holds that a further condition needs to be satisfied by perduring objects before they qualify as persisting: perhaps they need to be spatio-temporally continuous, or causally unified in some way.

The best known version of this view is Armstrong's:

> We do not normally speak of an earlier phase of an object as being the cause of a succeeding phase. But, in general at least, the earlier phase will be one of the nomically necessary conditions for the existence of the latter phase....Given the concrete situation, the recent existence of this desk I write on is nomically necessary for the current existence

> of this desk. For consider the concrete situation which obtained in
> this room a few minutes ago, but subtract from it the desk. It is
> nomically impossible that in that situation a desk should come to be
> in my room now having the same properties as the original desk.
>
> ...So we seem justified in saying that, for the vast majority of cases
> at least, preceding phases of a thing are a necessary part of the total
> cause which brings the succeeding phases to be... All this paves
> ther way for the suggestion, for most sorts of things at least, this
> causal relation between phases is a logically necessary condition for
> the *identity* of that thing through time.
> (ARMSTRONG 1980B, p. 75)

This gives us an alternative answer to the problem of strange objects from
section 4.3.2. Among such strange objects are arbitrary fusions of time-slices
from Richard Taylor and from Armstrong himself. On Armstrong's view, not
only are such things not persons, but they are not "identical through time"
— they do not persist. They do perdure, being partially located at each of
several times; but on the view presently under consideration, this satisfies
only one of two conditions necessary for persistence.

We also get a principled reason for saying that the Taylor-Armstrong fusion
is not a person. For plausibly, persons must persist. In the terminology, they
must be **continuants** rather than **occurants** (like events). Perdurantism
is often held to erode this distinction — in part, Armstrong's view is an
attempt to draw the distinction within a perdurantist framework.

An example of this is his treatment of the two-gods case described in section
4.2.3. He admits to an intuition that he "hope[s] the reader will agree with"
(ARMSTRONG 1980B, p. 76) that if a person is destroyed and instantaneous-
ly replaced with an intrinsic duplicate, they do not survive the experience.
This is a type of intuition that is often produced by people who are opposed
to perdurantism.[2] Armstrong's causal version of strong perdurantism can
satisfy the intuitions while also satisfying arguments for perdurantism such
as the problem of change (see section 4.2.2).

All this comes at a cost however. Armstrong's theory of persistence is depen-
dent on his non-Humeanism about causation. Apart from the two deities,
the world of Armstrong's thought experiment is just like the actual world. In

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[2]For example, Douglas Ehring makes use of a related "trope smasher" thought experi-
ment (EHRING 1997, p. 94) to argue for endurantism with regard to properties.

particular, the constant sucession of Taylor-stages by later Taylor-stages is just as it is actually. On a Humean account of causation, there is no reason to deny that the earlier part of Taylor's life is appropriately causally related to the later part, *in spite of the deities' meddling.*

4.4.2   Discrete versus Continuous Perdurance

I have thus far been supposing that if perdurantism is the right theory of persistence, then persisting things have temporal proper parts that do not, themselves, persist. I don't think any of my conclusions so far have depended on this, but it has made it easier to describe many of the arguments.

The view I have been assuming, **continuous perdurantism**, holds that persisting things are entirely made up of durationless slices. There must be continuum many such slices in any persisting, if they are to have a temporal measure — a duration.

The rival view, **discrete perdurantism**, holds that all persisting things are entirely made up of temporal parts which themselves persist, by being entirely made up temporal parts which themselves persist... and so on to infinity. On this view, there may be nothing which does not persist. It is important to realise that discrete perdurantism is distinct from a more common, non-perdurantist doctrine, that perduring things can be made of persisting things which themselves do not perdure. According to discrete perdurantism, everything that persists perdures.

A third possibility is that some thing perdure by having durationless temporal parts, and others perdure by having only perduring temporal parts.

It is hard to know how to choose between these three. Perhaps some of the considerations mentioned in connection with mereological atomism in section 3.5.1 could help? We might prefer temporally discrete, or "gunky" objects because of objections to the concept of continua. We might prefer a mixture because of a combination of such objections with topological considerations, such as those that motivated Suarez and Brentano.

In any case, I do not know of any considerations internal to the study of persistence that could help, so I will leave this distinction noted without deciding on which form of perdurance is preferable.

Chapter 5

Endurantism

5.1 The Theory

Endurantists agree with perdurantists that persisting objects are located at multiple times. However, they reject the further claim that persisting objects have distinct proper parts at each time at which they are located. According to **endurantism**, at least some persisting objects are *wholly* located at each of multiple times. An object that persists in this way is said to "endure".

Notice the distinction between saying that an object is wholly (as opposed to partially) located somewhere, and saying that it is singly (as opposed to multiply) located somewhere. To say that x is wholly located at t is to say that x is located at t, and there is no proper part of x that is located outside t. To say that x is singly located at t is to say that x is located at t, and there is no region outside t at which x is located.

According to endurantism, these two come apart for enduring objects. An enduring object may be located at t_1 and t_2, without having a part located at t_1 and not at t_2, or a part located at t_2 and not at t_1. Enduring objects have no proper temporal parts.

5.1.1 Strong endurantism

The way I've defined endurantism introduces an asymetry between it and perdurantism. Perdurantism is the doctrine that perdurance is necessary for persistence. Endurantism, on the other hand, is *not* the doctrine that

endurance is necessary for persistence, but rather that it is sufficient. Perdurantists believe that *every* persisting thing *must* perdure; endurantists that *some* persisting thing *might* endure. The reason for this is to arrange things so that these two options exhaust the possibilities for theories according to which multiple location is necessary for persistence. There is, however, a position, which I will call "strong endurantism", according to which endurance is sufficient and necessary for persistence.

5.2   Replies

5.2.1   The Analogy with Space: Rejecting the analogy

Recall that the argument from the analogy with space purported to establish perdurantism by appealling to an analogy between persistence and extension, where the latter is imagined to involve objects being partly located at each spatial location they occupy. For example, I fill up the space I do by having an arm here, a leg there, a torso there, and so on (see section 4.2.1).

One endurantist response to this is: so much the worse for the analogy between space and time! Judith Jarvis Thomson, having condemned the belief in temporal parts as a "crazy metaphysic", goes on to say that "its full crazyness comes out only if we take the spatial analogy seriously." (THOMSON 1983, p. 213) According to Thomson, the strange results which flow from the acceptance of temporal parts (especially cross-sectional temporal parts) undermine the analogy between space and time that is supposed to be used to argue for perdurantism. If there were any cross-sectional temporal parts, they would be different from spatial parts in important ways that show the disanalogy between space and time. In effect, Thomson's strategy is to take the argument from the analogy with space as a modus tollens against its first premise, 7. (See page 59).

Thomson offers two main points of disanalogy between spatial and temporal parts:

First, extended objects are often breakable into their spatial parts. Take the example of breaking a piece of chalk into a left half and a right half. "[I]t could hardly be said that [the right half] will come into existence at breaking-time — surely [the right half] does exist before I break it... off" (THOMSON 1983, pp. 211–212) So the breakability of the chalk gives us a reason for believing that it has spatial parts, even before the chalk was

broken; or, presumably, even if it were never broken at all. By contrast, it is not possible to break a persisting piece of chalk into two temporal halves.

Second, suppose I pick up a piece of chalk at t_1, and hold onto it for 2 hours. Consider its temporal part beginning at t_2, which is an hour later than t_1. Suppose it is now t_2. "[T]hen there is something in my hand which is white, roughly cylindrical in shape, and dusty,... which also has a weight,... which is chalk, which was not in my hand three minutes ago, and indeed, such that no part of it was in my hand three minutes ago. As I hold the bit of chalk in my hand, new stuff, new chalk keeps constantly coming into existence *ex nihilo*. That strikes me as obviously false." (THOMSON 1983, p. 213)

Comment on Thomson's arguments

I am not very impressed with Thomson's first argument. The possibility of breaking an object gives us a reason to believe that it has at least two spatial proper parts because it gives us a reason to believe that the object might have been mereologically just the way it actually is (that is, having the very same parts) while the parts were spatially discontinuous, which actually they are not.

That is, Thomson's argument is directed towards someone who holds that we need a special reason to regard objects that are continuous as having parts (I am moderately sympathetic to this — see sections 3.5.3, 5.2.2). This special reason (the possibility of discontinuity) is always available for spatial parts because it is always possible that an object's spatial parts be seperated.

Thomson assumes that an analogous reason is *not* always available for temporal parts, but I disagree: it is possible that the chalk's temporal part beginning at t_2 be seperated from its earlier part ending at t_2. It might have been that the earlier part ended, not at t_2, but an hour earlier, at t_1 — in that case we would have one bit of chalk being destroyed at t_1, followed by another, being created *ex nihilo* at t_2. Not the sort of thing that happens in the actual world, to be sure, but by no means metaphysically impossible. That is what it is like for a piece of chalk to be broken into two discontinuous temporal proper parts.

Thomson's second argument highlights a genuine problem with perdurantism. But it is not quite a killer problem. It is open to the perdurantist to bite the bullet and accept that any persisting object has temporal parts coming into existence *ex nihilo* at every moment. Indeed, an argument commonly

given for perdurantism — the Armstrong-Lewis sucessive creation argument (see section 4.2.3) seems to require that we think of temporal parts in just this way.

It could be said that though it is surprising that there is a new lump of chalk being created in my hand at every instant, this is because we do not ordinarily think about those lumps of chalk. As Thomson acknowledges, the temporal parts are not what we would ordinarily call "a bit or piece or chunk of chalk." (THOMSON 1983, p. 212) Perhaps even calling the temporal proper parts of a piece of chalk "lumps of chalk" is inapposite. If that is so, then it is not a problem that it is contrary to common sense for lumps of chalk to be popping into existence in my hand at every moment that I am carrying a piece of chalk. Common sense has no words for the things that are popping into existence in my hand at every moment, so it has nothing to say one way or the other about them.

But some puzzle still remains, I think. We would like some reason for believing in the temporal parts of pieces of chalk that are constantly popping into existence — some reason to add them to our ontology. It is not enough to say that common sense gives us no reason not to. No reason not to believe in temporal parts is not a reason to believe.

5.2.2   The Analogy with Space: Entension

I am now going to consider another response to the analogy with space. Suppose that, for whatever reason, we accept premise 7 in as strong a form as the perdurantist wants. (I am here referring to the formulation of this argument on page 59). Now the argument's weak point is premise 8.

Just as there is a debate to be had between endurantists and perdurantists about how things persist through time, there should be an analogous debate to be had about how things extend through space. Analogous to perdurance, we have pertension, filling space by having distinct parts in distinct places; analogous to endurance, we have entension, filling space by being wholly located in each of several places. The defence against the argument from analogy is that just as things might endure through time, they might (and perhaps do) entend through space.

I begin by arguing that, as a matter of empirical fact, some things do entend. I then address a number of objections to this proposal.

The Argument from Avogadro

Our world is a finite material object; and such things are only finitely mere-ologically complex. So there are only a finite number of mereological atoms. If there is no entension in the world, those atoms are all extensionless. Famously, however, a finite (or even a countable) number of extensionless points don't add up to anything extended. So unless something entends, or there are in fact continuum many atoms, nothing is really extended at all.

I call this argument the Argument from Avogadro, because its key premise — that finite things have only finitely many constituents — is connected with the 19th Century Italian chemist, Amedeo Avogadro.[1] I described it first in (PARSONS 2000) (reproduced as appendix C).

21 All mereological simples are extensionless.

22 There are only finitely many simples.

23 All objects are mereological sums of simples.

24 All objects are sums of finitely many extensionless things. (from 21, 22, and 23.)

25 All sums of only finitely many extensionless things are extensionless.

26 *Therefore,* All objects are extensionless. (from 24 and 25)

26 is absurd — if it was true, we wouldn't have a problem about whether things entend or pertend! I take this argument as a reductio against 21. It only remains to draw the contradiction explicitly:

27 But of course some objects are extended!

28 *Therefore,* Some simples have extension; they entend. (reductio against 21)

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[1]For a summary of Avogadro's scientific work, see Coley (1964). It is Avogadro's "molecular hypothesis" of 1811, discussed by Coley on pages 197–199 that is of particular interest to us.

So the upshot of this argument is that if we accept that there are only finitely many things, and that some of then are extended, we must hold that some, at least, entend. If you reject entension, the only alternative is that extended things be divisible into infinite numbers of parts.

The most important premise in this argument is 22. I take it that 22 is a discovery of physical science — the discovery of Avogadro's number, the number of hydrogen atoms in a gram of hydrogen. Armed with Avogadro's number, and a theory of the subatomic constitution of matter, we can arrive at a finite total number of the simple objects that make up any ordinary finitely massive material object, like a chair or a table (or the universe, for that matter).

The other independent premises, 23 and 25, do not require too much discussion. 23 might be rejected by someone who accepted some kind of abstract objects to which mereological concepts might not apply. However, there is no barrier to such a person accepting a weakened version of 23 which quantifies over only "all material objects", or "all concrete objects", or "all mereological objects"; and such a formulation would still produce the same conclusion, since the spatial concepts (such as extension) will surely not apply to any of the non-mereological objects anyway.

25 denies that extension might emerge from the fusion of extensionless objects. It will presumably be accepted by anyone who denies that there are extended simples — but nevertheless, there is a coherent position with respect to this argument that denies 25 while accepting 21. This position seems to have little to recommend it, though.

Another important question with respect to 25 is, should one continue to accept it after denying 21? There seem to be two coherent 'entensionist' positions, the weaker of which holds that objects either entend or pertend throughout the space they occupy, and the stronger of which holds that one and the same thing may locally entend through some regions of space and locally extend through others. It is only the stronger entensionism that rejects 25 along with 21.

As I have only an argument against 21 or 25, and not against both, I will restrict myself to the weaker entensionism. However, the stronger version does not seem as implausible as the combination of the denial of 25 with the acceptance of 21, and it would be interesting to explore the kinds of considerations that might lead one to decide between strong and weak entensionism. [topology?]

In the remainder of this section, I discuss a series of objections to either the premise 22, or to the very possibility of entension.

What are the simples?

Avogadro's number only tells us the number of physical atoms in an object; these are not of course, the most fundamental objects of physics. Contemporary physics' most fundamental objects are leptons and quarks. It regards them as mereologically simple (unlike nucleons, such as protons, which are made of quarks), and is silent on whether they are extended — they are, at largest, too small to be practically measurable.[2] There are only finitely many of these objects as parts of each of the finitely many atoms, so it is these things that we ought to expect to entend.

It might be objected that the fundamental material things are not the only mereologically simple objects. In particular, substantivalists might object to 22 on the grounds that it counts only the material objects, and not the continuum many point-instants of space-time.

In order to reply to this, I need to distinguish two kinds of substantivalism: reductionist substantivalism, which holds that material objects are to be ontologically reduced to points and regions of space-time (loci, for short), and anti-reductionist substantivalism, which accepts both loci and material objects, while denying that either is to be reduced to the other. Both positions are to be opposed to anti-substantivalism, which holds either that there are no loci, or that they reduce to material objects.

I need have no debate with the anti-reductionist substantivalist. I am only interested in the manner in which material objects like chairs and tables extend (or persist) and not in the manner in which regions of space-time do so. Plausibly, space-time, if it exists, extends by pertending, and persists by perduring — but that's not the issue here. The argument from Avogadro is intended to be restricted to material objects and material simples, and anti-reductionist substantivalist objectors are welcome to substitute throughout 'material simple' for 'simple' and 'material object' for 'object' throughout.

Replying to the reductionist substantivalist is harder. It seems to me that reductionist substantivalism is implausible precisely because regions of space-

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[2]For a readable introductions to the particle physics I am relying on here, see (DODD 1984), Fritzsch (1984), and (TREFIL 1980). On the radius of electrons, and the practical difficulties of measuring it, see Ridley (1995, pp. 133–138).

time do seem to be arbitrarily divisible into parts, in ways that material objects are not. The reductionist substantivalist therefore owes us an argument either that all material things are, afterall, divisible into parts corresponding to the subregions of the region they occupy, or that regions, are not, afterall, arbitrarily divisible into subregions. In the former case, it would be question begging to offer the truth of substantivalism as that argument, and in the latter, there is no problem for entension, as it is accepted that some regions may entend.

Tile trouble?

Let us turn now to the anti-substantivalist version of the view I am defending. Suppose that there are only finitely many extended material objects, and no other extended objects. There is a classic argument due to Hermann Weyl, that has been claimed to "hopelessly vitiate" (ZIMMERMAN 1996, p. 152) this kind of theory:

> How should one understand the metric relations in space on the basis of this idea? If a square is built up of miniature tiles, then there are as many tiles along the diagonal as there are along the side; thus the diagonal should be equal in length to the side.
> (WEYL 1949, p. 43)

Weyl's idea seems to have been that if lines in this kind of space is measured, as seems intuitive to do, perhaps, by counting the numbers of tiles a line passes through, the space seems radically non-Euclidean; in particular, the Pythagorean Theorem does not hold.

Suppose that the squares of figure 5.1 on the facing page represent entending "space atoms". The triangle ABC's hypotenuse, $\overline{AB}$, should be $\sqrt{2}$ the length of $\overline{AC}$ and $\overline{BC}$, but it will be observed that in fact it passes through only as many tiles as $\overline{AC}$ and $\overline{BC}$.

A particularly subtle part of this argument is that, as Wesley Salmon points out, changing the size of the tiles, in particular, shrinking them, does not reduce the error. Imagine dividing each tile in half: now $\overline{AC}$ and $\overline{BC}$ cover twice the number of tiles they used to. So does $\overline{AB}$: it is still out by a factor of $\sqrt{2}$. (SALMON 1975, p. 65–66)
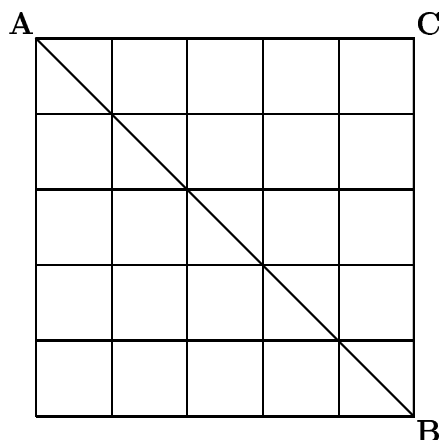
Figure 5.1: The Tile Argument

The weakness of the Tile Argument, at least in this form, is the premise that the length of a line should, on the "tile theory of space" be proportional to the number of tiles it crosses (for convenient reference, call this the Length Premise). Having stated the argument, Weyl goes on immediately to say that this premise is *rejected* by his principal target, David Hume:

> Hume, consequently, is forced to admit that the "just as well as obvious" principle of comparing the measures of curves and surfaces by means of the number of component elements, is, in fact, *useless*.[3]
> (WEYL 1949, p. 43)

If Hume admits this, how can the argument "hopelessly vitiate" his theory? Moreover, the Length Premise must not only denied by Hume (or those who hold, like Hume, that there are entending atoms of space) but even by those who hold the orthodox view that space is made of uncountably many unextended points. This is because, on this view, every line contains precisely the same number of points. There is a simple geometrical proof of this:

In figure 5.2 on the next page, each of the lines from the point P to each point in the line $\overline{IJ}$ passes through only one point on $\overline{GH}$, showing that there are no fewer points on $\overline{GH}$ than $\overline{IJ}$. (SALMON 1975, p. 55–56)

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[3] The citation to Hume is to book 1, part 2, section 4 of the *Treatise*. (HUME 1978, p. 45) The word "just" is italicised in Hume; Weyl omits to do so in his quotation.
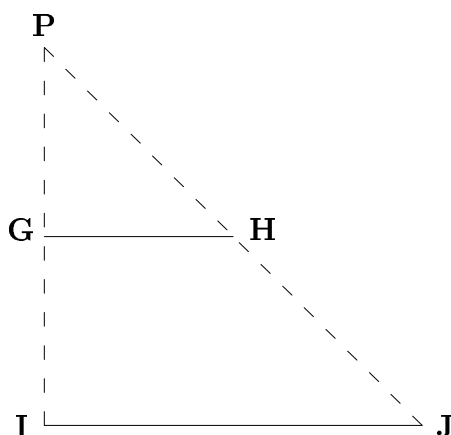
Figure 5.2: Every line contains the same number of points.

The point of the Tile Argument, then, cannot be that it poses a straight counterexample to the proposal that the length of a line is proportional to the number of tiles it crosses. The real force of the argument is in Weyl's challenge: "How should one understand the metric relations?" "What is the length of a line?" The tile theory of space owes us a geometry, and Weyl is sceptical that one will be forthcoming. On this construal the Tile Argument is certainly food for thought, but not the knockdown affair that its proponents represent it as.

In fact, it is perhaps asking too much that an empirical theory of the constitution of the universe provide an adequate ontology for a branch of mathematics. It is famously difficult to find natural objects corresponding to the ontology of number theory, or set theory: why should geometry be any different? The ontology of mathematics is a hard topic, to which there are no easy answers; until more progress has been made on that front, I think it is fair for an anti-substantivalist about space-time to put the Tile Argument to one side.

Is science in the business of doing mereology?

I have assumed that the nature and disposition of the smallest parts of material things is an empirical question. This may seem obvious, but it is not so to everyone.

Some will say, especially if the fundamental objects of physics turn out to be extended, that physics is just not in the business of discovering which

objects are the real mereological atoms. Rather, it discovers which things are, in practice, divisible, given the methods at our disposal. In moving from the in-practice indivisibility of fundamental objects to the view that they are mereologically simple, we cross the boundary from science to metaphysics.

This objection makes sense, I think, against the background of a broader scientific anti-realism. If you thought that, in general, that science does not discover how the world is, but merely what is, in practice, possible in a laboratory, you would be completely justified in making this objection. Of course, such a scientific anti-realist will be unmoved by the Argument from Avogadro in any case, and to argue against that position would be beyond the scope of this thesis. So let us set aside the general anti-realist objection, and consider whether the particular objection that science is just not in the business of finding the mereological atoms can work against a scientific realist background.

It is a truth familiar to scientific realists that theory is underdetermined by data. Scientific theories, understood as realists understand them, are not the sorts of things that can be conclusively verified, but we believe one such theory rather than another, on the grounds of arguments to the best explanation.

Now consider an experiment that attempts to break apart some putatively fundamental object, an electron, say, into its parts. The experiment fails, and there are two candidate theories available to explain this:

29 The electron has no proper parts.

30 The electron is in practice indivisible.

While both theories predict our result, it seems clear that only the first explains the result. The second only restates the result, and restatements are not ever explanations. To try to explain the fact that we did not split the electron by saying that it's unsplittable is like trying to explain a person's being put to sleep as a result of ingesting opium by appeal to opium's dormative virtue.

Perhaps though, 30 was not the theory that the objector had in mind. Perhaps the candidate theories are more like this:

29 The electron has no proper parts.

30′ The electron has proper parts, and they are indivisible.

Now both theories do both predict and explain the data; but we should still prefer theory 29. That is because 30′ introduces unobservable objects that do not aid us in the explanation of the phenomenon under consideration. Scientific realism is not a licence to believe in gratuitous unobservable entities — just as in the case of unverifiable theories, we should believe in them where and only where,

> [b]y supposing they exist we can give good explanations of the behaviour and characteristics of observed entities, behaviour and characteristics which would otherwise remain completely inexplicable. (DEVITT 1984, p. 104–105)

Failing to believe in the proper parts of the electron does not leave anything "completely inexplicable". There is a perfectly good explanation available, in fact; and that is theory 29.

To summarise: There is a logical gap, to be sure, between on the one hand, the data that we have empirically available to us, about which things are divisible into their proper parts in a laboratory, and on the other, the theories we concoct about which things have proper parts to be divided. But that is no big news: the underdetermination of theory by evidence is ubiquitous in science. If that alone means that science can say nothing about whether an object has parts, then science can say very little.

Different concepts of parthood?

It might be objected here that I'm not really disagreeing with anyone who uses the Argument from Analogy, as I'm working with a different concept of parthood. This objection thus turns on the idea that I have earlier called **mereological pluralism** (see section 3.5.4). However, there seems to me to be no good reason to accept pluralism.

I have throughout assumed (or at least, nothing I've said is in conflict with) the standard framework of "classical" mereology of Goodman and Leonard (GOODMAN 1951, pp. 42–51) (see also 3.1). This is also the mereology that is standardly used by perdurantists; so if there is something different about

the concept of parthood I'm using, it's not to do with the purely mereological features of that concept.

There is, however, one important quasi-mereological principle that might capture the difference between me and many perdurantists — the principle that Peter van Inwagen has called the Doctrine of Arbitrary Undetached Parts, or DAUP (see section 3.5.3):

> For every material object M, if R is the region of space occupied by M at time t, and if sub-R is *any* occupiable sub-region of R *whatever*, there exists a material object that occupies the region sub-R at t. (VAN INWAGEN 1981, p. 123)

DAUP is, in effect, the second premise of the argument from analogy. It asserts that every material object pertends. Naturally, a believer in entension must deny it. Naturally, too, those who wish to use the argument from analogy will affirm it.

Our question here is not whether DAUP is true or false (I have given an argument that it is false — the argument from Avogadro is such an argument) but whether someone who denies DAUP must have a different concept of parthood from someone who affirms it. The answer to this, I will argue, is clearly no.

The reason for this is that DAUP is only a quasi-mereological principle, not a mereological one. What I mean by this is that it essentially involves use of non-mereological concepts; namely, spatial ones: the concepts of regions and subregions of space. This why DAUP cannot either entail or be entailed by a formal axiomatic mereology like Leonard and Goodman's system, which makes use of only mereological and logical concepts.

It might still be the case, though, that our concept of part requires more than the merely formal requirements placed on it by axiomatic mereology. DAUP is not, however, a plausible candidate for such a requirement. This is because spatial concepts in particular seem to be independent of mereological ones: we are able to apply mereological concepts in non-spatial cases. For example: idealism might have been true — in that case it might have been that case that there was a non-spatial world. But it would still make sense to say of such a world that some spirits are parts of a certain community of spirits, or that some of their ideas, perhaps, are parts of each other. A more compelling example: it is natural to think of a mathematical set as having its

subsets as parts, as in (LEWIS 1991), but *pace* (MADDY 1990) these things are not normally thought to be in space and time.

Finally, against the proposal that the affirmation or denial of DAUP be considered an essential feature of the concept of parthood, consider the number of philosophers who must be unknowingly talking past each other when they argue over whether DAUP is true or false. van Inwagen considers serious arguments for DAUP in his paper (VAN INWAGEN 1981) from such luminaries as Roderick Chisholm and David Lewis. From all appearances there is serious metaphysical disagreement here. It should take a lot to persuade us that van Inwagen's views are in fact compatible with Lewis's.

An incredulous stare?

The final objection to entension may be that it is absurd, inconceivable, or impossible that something should extend without having parts. One answer to that is that it is conceivable because it is conceived, at least by me, and, indeed, by some other metaphysicians, of whom David Hume and Peter van Inwagen have already been mentioned. Additionally, according to van Inwagen (VAN INWAGEN 1990B, p. 98), Aristotle held that living organisms entend, and Weyl mentions the Mutakallimûn as believers, like Hume, in the "atomistic theory of space." (WEYL 1949, p. 43)

That entension has its serious critics is also, paradoxically, a point in its favour. As Hume put it so well:

> [C]an any thing be imagin'd more absurd and contradictory than this reasoning? Whatever can be conceiv'd by a clear and distinct idea necessarily implies the possibility of existence; and he who pretends to prove the impossibility of its existence by any argument deriv'd from the clear idea, in reality asserts, that we have no clear idea of it, because we have a clear idea.   (HUME 1978, I.II.iv)

The fact that there are so many substantive arguments against entension suggests that its detractors have a clear idea of what it is that they don't believe in, which tends to support the view that it is conceivable.

In any case, if it were demonstrably true that entention is absurd, the Argument from Analogy would be redundant. Given the Analogy Thesis, for any demonstration of the incoherence of entention, there should be an analogous demonstration of the incoherence of endurance, which could be used directly.

5.2.3   The Problem of Change: Indexed properties

The indexed property reply corresponds to Lowe's analysis 13, and to Lewis's "second solution" to the problem of temporary intrinsics. In reply to the semantic problem of change, the indexed property theorist says that 'at t' modifies the predicate of those sentences it appears in. So, "the poker is hot at t_1" and "the poker is cold at t_2" contain references to the same object, but they do not ascribe the incompatible predicates "hot" and "cold" to it. Rather, they ascribe the compatible predicates "hot-at-t_1" and "cold-at-t_2", respectively. The ontological correlates of these predicates, the property of being hot at t_1 and the property of being cold at t_2, are often called "temporally indexed properties".

In reply to the problem of temporary intrinsics, the indexed property theorist says that properties such as *being hot* or *being bent* are not had *simpliciter* by objects, but only in a temporally indexed version: *being hot at t_1* or *being bent at t_2*. When we say that something has a changeable property such as being hot, what we in fact assert is that it has the temporally indexed property of being hot at some time (usually hot at the present time).

The classic defender of this is N.L. Wilson:

> It is so obvious, so necessary that if Philip is drunk, Philip is drunk *at some time*, that if Scott wrote *Waverley*, he wrote it *during some period* — it is so obvious and necessary, that in ordinary language we generally drop the "at some time" and are left with the simple, the *too* simple, noun-copula-adjective form of sentence. (Perfidious ordinary language!)   (WILSON 1955, p. 597)

Wilson meant it to follow that the reference to a time modified the predicate — it is "shifted across the copula... from subject to predicate" he says (twice). (WILSON 1955, pp. 592, 594–595)

What is not so clear is how we are supposed to read off the ontology behind the language from this. In 1955, Wilson seemed to hold that he was not disagreeing with perdurantists such as Quine as regards ontology. His complaint was rather that

> Ordinary language is a substance [ie. indexed predicate] language, and, whether we like it or not, we have not the slightest intention of abandoning this language *type*.   (WILSON 1955, p. 592)

By 1973, however, he was prepared to say that "[a] fact is constituted by an individual, a property, and a time, and it cannot have fewer components." (WILSON 1974, p. 311). True to the *Tractatus*, however, whose doctrines he cites approvingly, Wilson is silent on the all-important question for ontologies of facts: what is the relation of the fact to its constituents? There may be a fact that Philip is drunk at 3 o'clock, but there cannot be a fact that 3 o'clock is drunk at Philip. Why is this? The answer cannot be simply that times can't occupy the 'individual place' in a fact, for there may be the fact that 3 o'clock is past at 4 o'clock, or the relational fact that Philip anticipates 4 o'clock at 3 o'clock. These are not identical, of course, to the fact that 4 o'clock is past at 3 o'clock, or that Philip anticipates 3 o'clock at 4 o'clock. Wilson owes us an explanation of these phenomena, but he does not give one. This is not to say that his account is mistaken, though, rather that it is indeterminate between a range of different options that might be exposed to different problems. Since these are problems in the ontology of facts, rather than of time, I will put them to one side here.[4]

Something rather similar to, and better known than, Wilson's ontology of temporal facts has been proposed by D.H. Mellor. In 1981, Mellor held that,

> if *a* is a thing, it has no temporal parts to take over properties *G* and *G**. They are properties of *a* itself, albeit at different times. They are in short relations *a* has to the times at which it has them. (MELLOR 1981, p. 111)

Here *a* is a changing thing, like our poker; *G* and $G^\star$ are the incompatible properties with respect to which it is changing: in our example, the properties of being hot and being cold respectively. The view, then, is that temperature is not in fact a monadic property at all, but a relation; as is every changeable property.

It is important to realise that this view, that changeable properties are relations, is not essential to the indexed property theory; nor is it clear that this really what Mellor wants to say (even though he does say it, for example in the quotation given above). A more plausible way of putting Mellor's 1981 theory would be to say that changeable properties are relational. Mellor himself does not seem to distinguish this from the claim that the properties are relations, but they are importantly distinct.

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[4]See (ARMSTRONG 1997, pp. 119–123) for one view, a standard one, on the relationship between facts and particulars. My (PARSONS 1999) defends a rather different, non-standard one — also taken up by (LEWIS 2001).

What may be neutrally said on the behalf of both theories is that when a poker is hot at a time, there is some relation, G, holding between the poker and the time. In addition, the analysis of sentences like "the poker is hot at t_1" is an indexed predicate analysis, so that "hot at t_1" is a semantic atom, expressing the relational property of bearing G to t_1. This doesn't commit us to the claim that G is hotness, the property of being hot simpliciter. Plausibly, G is a relation we don't yet have a name for, though we can make one up — "hot at" perhaps.

This should silence Lewis's objection that we know, don't we, that temperature (or shape, or whatever property is being used as the example) is a property, not a relation. (LEWIS 1986, p. 204) (MERRICKS 1994, p. 168) This surely right: if anything is hot, it's pokers, not ordered pairs of pokers and times! But Mellor doesn't need to say that any property we now have a name for is the relation G. As for hotness simpliciter, recall what Wilson found "so obvious and necessary", that this is the property of being hot at some time — a relational property, but not a relation!

There's an instructive parallel to Mellor's 1981 proposal in the discovery that weight is a relational property. Suppose I have a poker that weighs 30 Newtons here on Earth, but weighs 5 Newtons on the moon. How is it possible for one thing to have two different weights? The answer is simple: there's a relation H that holds between things and planets on the surface of which the weight is being measured. The poker bears H to Earth, but doesn't bear H to the moon. To say that the poker weighs 30 Newtons on Earth is to say that the poker has the property H-on-earth, which is compatible with not having the property H-on-the-moon.

It would be a bad objection to this to say that surely we know that weight is a property not a relation. We do know that, but the relation H is not the poker's weight — it is the relation "weighs 30 Newtons on the surface of". The poker's weight, we know, is a relational property; but not a relation.

5.2.4   Intrinsic Indexed Properties

There is a problem remaining for the indexed properties approach. In the previous section I considered the objection that it makes properties that ought to be monadic into relations; and the objection that it makes properties that ought to be non-relational into relational ones. Neither of these were found to be sound.

However, in the light of what I said about the relational / non-relational distinction in section 2.1.6, we also need to ask whether the indexed properties solution might not make properties that ought to be intrinsic relational properties into extrinsic relational properties.

The perdurantist can agree with the indexed property theorist to a certain extent. Yes, there are such properties as *being hot at* t_1; yes, these are relational (in whatever sense properties may be said to be relational!) — but not all of them are extrinsic. Supposing that *being hot* is intrinsic, then *having a hot part at* t_1 is intrinsic too, and this property, the perdurantist thinks, is none other than *being hot at* t_1.

You might think that not even *having a hot part at* t_1 can be intrinsic, as it makes essential reference to a moment of space-time. Having the property of *having a hot part at* t_1 entails being located at t_1. But being located at t_1 is extrinsic. Hence, any property the having of which entails that I am located at t_1, cannot be intrinsic.

The answer to this is that we should understand "t_1", as it appears in the names of the temporally indexed properties, as a reference to a moment of time relative to the temporal position of the object that has the property. So we should understand the property of *being hot at* t_1 as, for example, the property of *being an x such that x is hot for the first second of x's life*. The temporally indexed properties should be understood in a way that makes it possible for objects located at two different times to share such a property. If two pokers, created at different times, were to have the same history of cooling down, and being destroyed, they would share all their temporally indexed heat properties.

This shows that the perdurantist can give an account of the indexed properties that accepts that some of them are intrinsic. Can an endurantist do as well? It seems to me that they can, if they adopt the strategy I recommended in (PARSONS 2000), of identifying indexed properties with disjunctive **distributional properties**.

Dsitributional Properties

The surface of a chessboard has a certain colour distribution. The property of having *that* colour distribution is a distributional property.[5] Or, take

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[5]I introduced the concept of a distributional property in (PARSONS 2000, p. 410) (reproduced as appendix C). See also appendix F

a poker that is hot at one end, and cold at the other. It has a certain
heat distribution, and has the distributional property of having that heat
distribution. Imagine such a poker, call it a, and another poker, b, which
has a different heat distribution, being uniformly hot, for example. Call
the heat distribution of a, the property A, and that of b, B. Note that
these distributional properties are fully determinate: having any one of them
entails that you do not have any other of the same determinable (in this
case the determinable property of having some heat distribution). So, for
example, that a has A entails that a does not have B.

A and B are both intrinsic properties. Though my description of A involved
talking about 'ends' of the poker, it's clear that having A involves nothing
outside the poker that has the property. Any duplicates of a would have to
also have A, or they would not be duplicates. Now notice that we can define
now up the property of being hot at one end. It is simply having A *or* B
or any other of the fully determinate heat distribution properties that, as it
were, put heat at one end of the object. And this property is intrinsic as well.
You can't get an extrinsic property by conjoining or disjoining two intrinsic
ones.

A distributional property, then, is a perfectly intelligible kind of property,
which everyone ought to believe in to the extent that they believe in any kind
of intrinsic property. Disjunctions of them are equally intelligible, and ought
to be believed in to the extent that one believes in any disjunctive property.

The disjunctive distributional properties I have just described are spatially
indexed properties. For temporally indexed properties, apply this procedure
in the temporal case. Imagine now two pokers, one of which begins its life
hot, and cools down over time, the other of which remains hot for its entire
existence. Call them c and d respectively. Both c and d, we will suppose,
begin to exist at t_1, and are destroyed at t_2. If we accept that persisting
objects are multiply located, then we will think of c and d as four-dimensional
objects, extended over time. Just like a and b, c and d have different heat
distributions. c is hot at one end, its earlier end, and cold at the other; d,
on the other hand, uniformly hot. Just as before, let us give names to their
heat distribution properties: c's can be C, and d's D.

Now we can define up the property of being hot at t_1 as the disjunctive
property of having either C or D, or any of those other heat distribution
properties that, as it were, place heat at the t_1 end of their instance. Just
as in the spatial case, this property is perfectly intrinsic and non-relational.
Nor, I think, need it commit us to there being any proper parts of an object

which has such a property.

To generalise: wherever we have a temporally indexed property of *being ϕ at t*, we have a number of corresponding permanent distributional properties: the ϕ distributions. *being ϕ at t* is a disjunction of some of those ϕ distributions, namely, the ones that are compatible with *being ϕ at t*.

The Problem of Difference

The same mechanism can be used to solve the problem of difference referred to in section 3.5.4. In that section I said that it is possible that things as seemingly different as a strawberry and a potato might turn out to be numerically identical; indeed, it might be that the world is superfically just as it actually is, but there be only one thing, the Absolute.

The problem of difference is the problem that the Absolute would appear to be intrinsically qualitatively different from itself. A potato and a strawberry are intrinsically different — strawberries being sweet while potatoes are not.[6] If the Absolute is identical to both, then it seems we can derive a contradiction from the hypothesis of Absolute monism, contrary to what I claimed earlier.

Strictly speaking, however, what we should say of the Absolute is that it has a certain sweetness distribution. It is sweet over here, not sweet over there, where *being sweet at p* for some position p is understood as a disjunctive sweetness distribution.

5.2.5   The Problem of Change: Adverbialism

Adverbialism is best presented as a reply to the semantic problem of change. It corresponds to Lowe's analysis 14, in which the "at t" phrase is supposed to modify the copula. As Lowe puts it, the

> ascription of a shape to *a* is *temporally qualified*, i.e., the property-exemplification relation between *a* and a shape is relativised to a time... [the indexed copula solution] retains *a* and *F* as subject and predicate respectively and takes 'at t' at its face value as having adverbial (or predicate modifier) status.   (LOWE 1988, p. 73)

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[6]I am assuming a primary property theory of sweetness here.

This idea has also been taken up by Sally Haslanger:

> The intuitive idea behind the so-called 'adverbial' option is that objects have properties at times, and that time should modify this 'having' rather than the subject or the property. Lewis interprets this in terms of a commitment to a three-place instantiation relation which takes objects, properties and times as arguments.
> (HASLANGER 1989, p. 120)

There seems to be a lot of confusion in these proposals. Remember that we are supposed to be dealing with a semantic problem here — as Lowe would surely agree, once we start speaking of three-place (or any place) instantiation relations, we are into deep metaphysics. What is left of adverbialism, once we shear it of metaphysical suggestions about the ways in which objects instantiate properties? Only one thing: Lowe's comment that the "at t" phrase of "a is F at t" is has "adverbial (or predicate modifier) status."

This is not sufficient to distinguish adverbialism from the temporally indexed property solution discussed in section 5.2.3. Normally, adverbs modify the semantic value of the predicate of sentences they appear in, which is just what "at t" does according to the indexed predicate theory. Lowe wants to deny that "at t" works this way: according to him, the trouble with the indexed property solution is that it is "revisionary about predicates" (LOWE 1988, p. 73), a problem the adverbial solution is supposed to lack.

How to understand adverbialism

For this reason, we must take the label "adverbial" with a grain of salt, as Haslanger's scare quotes suggest. I cannot really extract from Lowe's text what the distinctive answer to the *semantic* problem offered by the indexed copula solution is supposed to be. I can see two further possibilities for what Lowe might have had in mind, though, beyond the adverbial one, for a total of three ways of understanding the indexed copula solution:

1 "at t" is an adverbial modifier. As already noted, this collapses into the indexed property solution. However, it could be accompanied by a distinctive metaphysical story involving relativised instantiation relations. I believe that this is the only plausible reading.

2 "at t" modifies the copula "is". This is suggested by the way in which Lowe presents the taxonomy of solutions, attaching "at-t" with a hyphen to different words in the sentence-schema "a is F". The trouble here is that the copula has no semantic value to modify — it's entirely an artifact of English grammar! Though other natural languages have the copula, its only function is to convert an adjectival phrase like "hot", "drunk at t_1", "weighing 50 Newtons on the moon" into the corresponding verb phrases "is hot", "is drunk at t_1" etc. It's quite possible for artificial languages such as standard quantificational logic to have no copula at all. Even natural languages can get along without it: "Philip drinks at t_1" is a perfectly respectable instance of the type of sentence we are trying to analyse here, and it has no copula.

3 "at t" modifies the semantic value of the whole sentence without modifying the semantic value of its parts. It is, in other words, a sentential operator. Since it is obviously not truth functional, it must be intensional, like a modal or belief operator. "The poker is hot *at t*" is thus to be likened to such usages as "Holmes lived at 21B Baker St. *according to the Sherlock Holmes stories*" or "Shipley won the 1999 election *in the possible world w*". This is a familiar account of the function of "at t" (it's the account endorsed by presentists) — but it is one that Lowe explicitly leaves out of his taxonomy.[7]

So I find nothing but confusion in the idea that adverbialism represents a distinctive answer to Lowe's "semantic problem": the problem of semantically analysing "a is F at t". Most plausibly, I think, the 'adverbial' proposal should be seen as a variant of the indexed property proposal, with an additional suggestion as to the underlying metaphysics. That suggestion is: avoid the charge that temperature, drunkenness, shape etc. are relations by relativising not temperature, drunkenness, shape, etc. (as Mellor did) but the instantiation relation holding between these properties and the objects that have them.

I think I have already undercut the motivation for the adverbial solution by arguing that, in any case, the indexed property solution need not entail that temperature, drunkenness, etc. are relations. This aside, though, the adverbial solution has its own problems.

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[7]Lowe says of his three solutions: "These do not correspond exactly to Lewis's original three candidate solutions: the first and third correspond to his first and third, but the second corresponds to a solution mentioned in Lewis's first footnote." (LOWE 1988, p. 73) Lewis's "second solution", which Lowe has left out, is the one now under consideration. (LEWIS 1986, p. 204)

We need not worry too hard about the hotly debated point (LEWIS 1988, fn. 1) (HASLANGER 1989, pp. 120–122) of whether the 'adverbial' solution entails that there is a three-place instantiation relation. You might think of the "at t" as supplying a time to fill the third place of an instantiation relation. Or you might think that there are two-place instantiation relations corresponding to each time, and that "at t" disambiguates between them. In the latter case, it's easy enough to define up a three-place relation between an object, a property, and a time, which holds iff the two-place instantiation relation associated with that time holds between that object and that property.

Objections to adverbialism

Here's what I understand the 'adverbial' solution to be saying: we analyse "the poker is hot at t_1" into the subject "the poker", and the predicate "is hot at t_1". The predicate expresses the relational property of bearing the instantiation relation $t_1$ly to hotness. Hotness is a monadic property, not a relation. "bearing the instantiation relation $t_1$ly" is to be understood in either of the two ways described above.

My objection in either case will be the same: just as requiring a copula to link subject and predicate was bad grammar, requiring an instantiation relation to link objects and properties is bad metaphysics. "The danger", Haslanger rightly says, "of a three-place instantiation relation is that it invites us to treat objects as related to their properties as individuals are related to other individuals; this would be undesirable." (HASLANGER 1989, p. 122) I might add that the undesirability is identical if a two-place, or any instantiation relation is admitted.

The trouble is that the instantiation relation itself is a property, and if objects must be related to their properties by instantiation, then a second instance of the instantiation relation is needed to relate the original object and property to instantiation; and a third to relate those three items to instantiation again, and so on ad infinitum. If any explanatory work was done by bringing instantiation into the picture, it cannot be completed. This is a version of F.H. Bradley's celebrated regress of relations. (BRADLEY 1897, p. 18) (ARMSTRONG 1978A, p. 106).

The force of Bradley's argument is that predication cannot be analysed in terms of instantiation. (LEWIS 1983B, pp. 21–23) Any such analysis will still contain predication — of an instantiation relation. It's just such an

analysis that the adverbialist is attempting: they want to analyse "a is F at t" in terms of "a bears the instantiation relation at t to F-ness". But this is just plain circular, for "a bears the instantiation relation at t to F-ness" is just another predication.

5.3   Arguments

The positive arguments for endurantism are mostly reactive — they argue against perdurantism by claiming that perduring objects cannot change (section 5.3.1); or that, if it is possible to defuse the positive arguments for perdurantism, endurantism appears to be a reasonable generalisation of perdurantism (section 5.3.2).

5.3.1   The Essential Temporality of Change

According to D.H. Mellor, first, there is an important distinction between change and mere difference; second, this distinction is underwritten by an important metaphysical difference between persistence and extension; and third, this difference is that changeable things must persist by enduring.

Mellor's stalking horse is the theory according to which things change if and only if they are non-uniform over time; the view that, as D.C. Williams says, "the 'change' of a leaf's color from day to day is of the same denomination as its 'change' from inch to inch of its surface". (WILLIAMS 1966, p. 306)

On Williams's view, ordinary language makes a metaphysically gratuitous distinction between the temporal and spatial cases of non-uniformity, calling the former "change", and the latter not. In fact, it does not even do this consistently — it is natural to say "the river changes colour as it reaches the sea". I will call this the doctrine of **Change as Non-uniformity**.

Richard Taylor has also urged this same idea:

> [T]ime has always been thought of as an essential ingredient to motion and change... This way of looking at things is no more than a reflection of certain predjudices, however.

> [S]omething, such as a wire might be blue at one end and red at another, and perhaps various other colors between these two places.

> This would accordingly be an example of *spatial* change. This sense
> of "change" is not, moreover, strange or unusual. It would make
> sense, for instance, to say of a wire, which was found to be red in
> one town and blue in another, that *somewhere...* between those two
> places it changes color. (TAYLOR 1992, p. 73–74)

Mellor believes that this way of thinking papers over an important metaphysical distinction. He gives the example of

> Jim and his grandson Jake, who is conceived after Jim dies and has
> a different blood group. Because Jim and Jake are different people,
> this difference between them is not a change.... For it is not a change
> in Jim or Jake, neither of whom ever changes his blood group; nor
> is it a change in their family, which, as a whole has no one blood
> group. So, since it is certainly not a change in anything else, it is
> not a change at all. (MELLOR 1998, p. 89–90)

Mellor goes on to argue that, for the same reasons, differences between the parts of an extended object cannot constitute a change:

> Take the poker that is hot at one end, and cold at the other. This is
> not a change in either end, since in neither end is there any difference:
> one end is all hot, and the other is all cold. Nor is it a change in
> the poker, which as a whole is neither hot nor cold; and nothing can
> change it from being hot to cold if it is neither. And if this difference
> is not a change in the poker or either of its ends, it is not a change in
> anything else, so it is not a change at all. (MELLOR 1998, p. 90)

The crucial point about the poker case is *not* simply that we would not say that the poker changed. According to Change as Non-uniformity, the poker only changes if it is non-uniform over time, and the case just hasn't said anything about that yet. What's crucial is the parallel with Jake and Jim. We are supposed to think that change in blood group has not occured in the Jake and Jim case for the *same reasons* that change in temperature has not occured in the poker case.

We are supposed to think that in the Jim and Jake case, there is an out: the difference in blood group could constitute a change, if Jim and Jake were

the same person. The way that a person persists makes it the case that a difference between the temporal extremities of the person counts as a change. However, the way that a family persists (by having a person here, a person there) is too like the way an object extends over space (by having a part here, a part there) for such difference to count as change.

Therefore, contra Williams and Taylor, persistence is unlike extension, in that there are two possibilities for the way things can persist: the way that a person persists, which allows the possibility of change, and the way that a family persists, which does not allow this. Only the latter is analogous to spatial extension.

I think that there are two things wrong with this argument. First, as I argue in section 5.2.2, things can (and do) sometimes extend through space (i.e. by entending) in the way that Mellor thinks persons persist through time (i.e. by enduring): by being wholly located at each of several temporal or spatial places. If I am right, then there are two possibilities for the way an object extends through space, analogous to the two possibilities for the way an object persists through time — Mellor cannot appeal to an metaphysically important disanalogy between space and time on this point.

Second, it is not clear to me that the two cases Mellor mentions parallel each other in the way that he needs. That is, the reason that we say there is no change in the Jim and Jake case is not the same as the reason we say there is no change in the poker case.

The plausibility of the Jake and Jim case hangs on the fact that Mellor throws in the option of believing that the family might change in virtue of having distinct members who have different blood groups, and then tells us that a family cannot change its blood group because it does not have a blood group to change.

In fact this depends on what we think the ontological status of families is. There is a temptation to think that families are a kind of abstract object like sets, which don't have blood groups, because they don't have blood. But that cannot be what Mellor wants us to think, because it breaks down the analogy between this case, and the case of the poker. The family is supposed to be changeless because it is related to Jake and Jim in the same way that the poker is to its ends. That is, the family must be regarded as a mereological fusion of its members, rather than some abstract thing.

With this out of the way, it is hard to see why we should not think of the family-fusion as changing its blood group. It certainly has blood, and

may, thereby, have a blood group. It probably has more than one; but why should this interfere with its blood group changing? According to Mellor, it is at least a necessary condition of something's changing that it have two incompatible properties at two different times (MELLOR 1998, p. 89) — so anything that changes its blood group must, on Mellor's own account, have at least two blood groups.

The "family... as a whole has no one blood group." — non sequitur! Mellor positively requires that an object have more than one blood group, if it is to change as regards its blood group. Indeed this seems to be what he has in mind when arguing that the poker does not change from being hot to being cold, because it is neither hot nor cold.

So, insofar as the Jim and Jake case is convincingly a case in which no change is described, it is not analogous to the poker case. And insofar as it is analogous, there is no pressure to deny that the family as a whole has changed.

5.3.2 Generalisation

Endurantism, as I understand it, is a weaker doctrine than perdurantism. The endurantist and the perdurantist agree that persisting objects are located at multiple times. At this point, the endurantist says no more, while the perdurantist goes on to say that persisting things have distinct temporal parts at each time at which they are located.

Understood this way, endurantism does not need to deny that things may persist by perduring. Rather, it holds that perdurance, if it ever occured, would be sufficient, but not necessary, for persistence. Individual endurantists also hold that there are apriori reasons for thinking that nothing, or no changing thing, could perdure, as discussed in sections 5.2.1 and 5.3.1, but it is not necessary to accept this to be an endurantist.

Perdurantism is on a par with the position I have have called strong endurantism, the view that endurance, and endurance only, is necessary for persistence. The onus is on the holders of these positions to take us beyond the assumption that both positions share, that persisting things are located at multiple times, to the stronger views, either that persisting things are partially (never wholly!) located at multiple times, or wholly (never partially!) located at multiple times.

Thus, if the arguments for pedurantism (or for strong endurantism) are un-
convincing, we should believe endurantism.

5.4   Problems

I discuss one outstanding problem for endurantism, to do with temporary
parts (section 5.4.1). This problem is connected with the issues to do with
material constitution and mereological extensionality that were briefly dis-
cussed in section 3.3.1.

5.4.1   Dion/Theon cases

The problem of change, at least in the version presented by Lewis, concerns
objects having temporary properties. A variant on this idea uses temporary
parts. For example, in a puzzle from the Stoic philosopher Chrysippus, an
unfortunate man called Dion has his foot annihilated, at some time t_1. Dion
survives this accident. Now, speaking in the atemporal language of classical
mereology, what do we say about the relationship between the Dion and his
foot — is it a part of him or not? (BURKE 1994)

There are only two ways to answer this puzzle within the confines of classical
mereology. We might interpret classical mereology so that its formulae are
implicitly present-tensed. This is a possibility that I will take up later, in
section 6.3.2. In that case, the answer is that whether the foot is part of
Dion depends on whether the foot exists at the time of utterance.

The alternative requires that there be temporal parts: Dion has a temporal
part prior to t, which the foot is eternally part of; and he has a distinct
temporal part after t, which the foot is eternally not part of. Dion has both
temporal parts eternally as well. Now, in fact, this is not just a gratuitous
introduction of temporal parts. It is in fact required of anyone who accepts
that the theorems of classical mereology are eternal truths.

To see why this is, suppose that Dion has the minimal number of proper
parts required to satisfy the hypothesis: a foot (Foot) and a body minus
that foot (Dion - Foot), or to give it a proper name, Theon. Suppose that
both Theon and Foot endure throughout their lives.

Both Theon and Foot are respectable spatial parts. Foot, however, is also
a temporal part. Recall our definition of temporal part from section 4.1: a

temporal part of an object is either the object itself, or a part that is located at some but not all of the times at which the object is located. And indeed this is true of Foot (see figure 5.3).
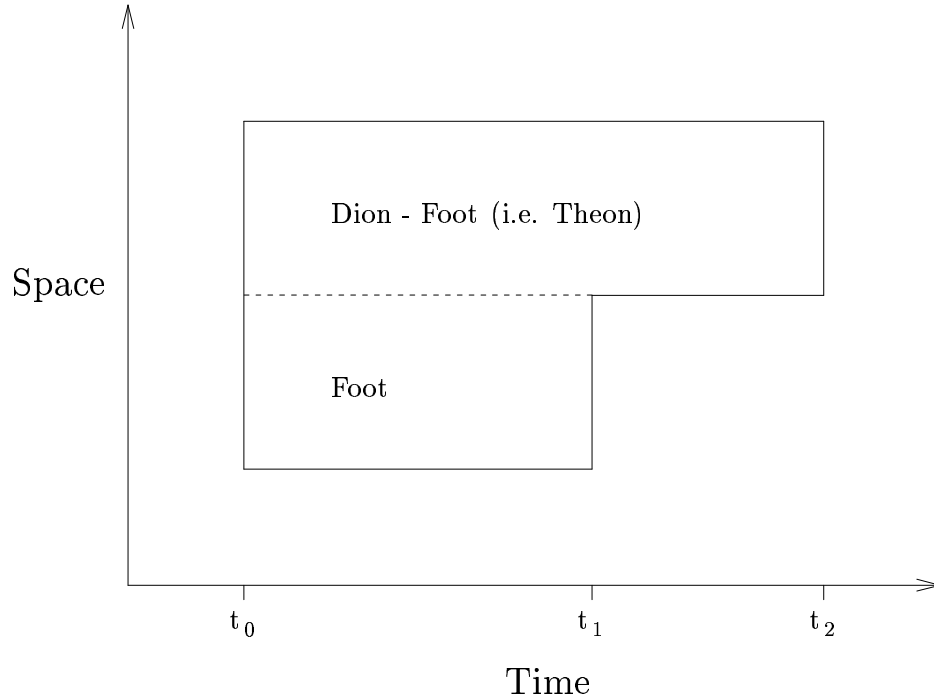
Figure 5.3: Dion and Theon

The temporal part of Dion prior to t_1 is simply Dion. The temporal part of Dion after t_1 is Theon. Dion has Foot as a part, Theon does not. All this follows just from the description of the hypothesis, provided we think of the objects in question as multiply located, and the part-whole relation as holding eternally. Whatever reasons we have for thinking that Dion survives his accident are reasons for thinking that Dion has perdured, not endured, through a change of parts.

Nor will the distributional properties approach answer this argument. To replace the part-whole relation with a "parts distribution" would be to revise classical mereology; even if the idea of a "parts distribution" were intelligible, which I am not sure that it is.

Note that this argument does not refute endurantism or establish perdurantism; it shows instead that the position I described earlier as strong endurantism is false. If things can survive the removal of a part, then some things perdure; however, it need not be the case that everything that persists

perdures.

5.5   Variants

I discuss just one variant on endurantism: the claims that some objects endure while others perdure (section 5.5.1). It seems to me that this gives an appropriate answer to the problem of Dion and Theon.

5.5.1   Mixed Theories

A **mixed theory** of persistence is one according to which some things persist by perduring, and others persist by enduring. By my definition, this is a type of endurantism, and it is commonly enough held by self-ascribing endurantists. There are three main motivations for such a view:

> ‹ **The continuant / occurent distinction.**
>
> Some endurantists, such as Mellor, believe that there is an important distinction between those persisting entities that can change (like material objects) and those that cannot (like processes or events). This distinction is often identified with the distinction between those objects that endure, and those that perdure. It is thought by these endurantists that endurance, while not a necessary condition of persistence, is a necessary condition of change, and that there is an important category of persisting objects for which this condition is not met.
>
> I have already discussed this view in section 5.3.1, so I won't repeat myself here.

> › **An answer to the problem of change.**
>
> It might be thought that the problem of change does not refute endurantism, if there are objects that are not undergoing intrinsic change at every moment at which they exist. Perhaps objects endure up until the point at which they change, perdure over that moment, and then start enduring again.
>
> This view could seem undermotivated — but in fact, I think, it could be motivated by a desire for parsimony with respect to temporal parts. We should only believe in as many temporal parts as we need to. So,

if I did not have an answer to the problem of intrinsic change already, I would be attracted to this option.

fi **An answer to the Dion / Theon problem.**

It seems to me that a mixed theory of persistence is the right conclusion to the argument presented in section 5.4.1. Objects that otherwise endure can change their parts; when they do so, they automatically perdure. This does not seem to me to be any kind of concession to perdurantism, either: in the remainder of this section I will explain why.

An object x undergoes a **Cambridge change** at t iff before t it was true to say that "x is ϕ", and after t it was true to say that "x is not ϕ". Because we place no constraints on ϕ, here, every object undergoes a Cambridge change at every moment at which anything changes. Suppose ϕ expresses the property *being such that there are precisely 100 sandcastles on the English coast*. At the moment, t, that such a sandcastle falls, the Great Pyramid undergoes a Cambridge change because before t it is true, and after t false, to say "The Great Pyramid is ϕ".

It seems odd to say that the Great Pyramid changes because of the fall of a sandcastle. This goes to show that we need to distinguish **intrinsic change** from mere Cambridge change. The property of *being such that there are precisely 100 sandcastles on the English coast* is not a respect in which the Great Pyramid can change intrinsically. Among Cambridge changes, some are intrinsic, and some are not — they are mere-Cambridge changes.

Similarly, I think, we need to distinguish among the intrinsic changes between those that involve the creation or destruction of an object, and those that do not. The former kind are **substantial changes**, the latter mere-intrinsic changes. The type of change that Dion undergoes when his foot is annihilated is the paradigm of a substantial change; whereas the types of changes that are used as examples of the problem of change — cooling down, bending, becoming drunk — seem importantly not to involve creation or destruction.

To believe otherwise is to subscribe to a kind of essentialism about intrinsic properties — to believe that intrinsic change is not possible without destruction or creation — a type of essentialism that I complained about in another context in (PARSONS 1999) (see appendix A). It seems to me that this essentialism is quite gratuitous, and so we should respect the distinction between substantial and mere-intrinsic change.

If this distinction is well founded then: first, we have another objection to perdurantism (which I regard as the decisive one) — namely that it conflates the distinction by assimilating intrinsic change to substantial change. And second, it would seem reasonable to treat the way in which objects persist through substantial change differently to the way we treat the way in which objects persist through mere-intrinsic change. This is what I propose to do: objects perdure through substantial change, and endure through mere-intrinsic change (as well as through mere-Cambridge change, or periods of no change at all).

Chapter 6

Presentism

6.1 The Theory

Presentism is a popular turn in philosophy of time which holds that many problems about time are solved by recognising that everything there is is present; nothing is past or future. It follows that no object is located at any time other than the present — there are no such times for objects to be located at. Every object, according to the presentist, is located at one and only one time: the present. Presentists must, therefore, reject what perdurantists and endurantists agreed on, that being located at multiple times is a necessary condition for persisting.

Presentism is not a simple doctrine about persistence, but a comprehensive philosophical theory of time. The two key planks of this theory are what I will call "tensism" and "anti-realism (about the past and future)".

6.1.1 Tensism

Tensism is the doctrine that tense is unanalysable (with analysis construed fairly broadly).

Tensed sentences are not logically equivalent to any tenseless sentence, according to tensism. Nor are sentences asserting that a tensed sentence is true equivalent to any tenseless sentence. This second clause is needed because presentists wish to reject analyses of this form:

Given some tensed sentence, say 31,

31 There were dinosaurs.

we analyse it by giving its truth conditions in a sentence such as 32

32 31 is true iff there are dinosaurs at a time earlier than the tokening of 31.

Presentists reject these analyses because they wish to hold that there *were* dinosaurs without being ontologically committed to dinosaurs (which, if they exist, are past). But if 32 is true, then to accept 31 is to accept the right hand side of 32, that there are dinosaurs at some time. So presentists reject analysis 32, and all analyses like it — they affirm tensism.

Strong Tensism

In the discussion above I made free use of a distinction between tensed and tenseless sentences. Even the non-presentist accepts that there is a perfectly good sense in which there are no dinosaurs: the last one died about 64 million years ago. This is the present tense use of "there are no dinosaurs". But, for the non-presentist, there is another, important sense in which "there are no dinosaurs" is false, for there are past dinosaurs, and a past dinosaur is a kind of dinosaur. The former sense is where "are" is a verb in the present tense; the latter sense is where "are" is a 'tenseless' verb.

English fails to distinguish between the two, but it is perfectly possible to introduce a distinction of this kind for philosophical purposes. One convention for making this distinction explicit in English is to render tenseless verbs in italics (SMART 1963, p. 133) another, in parentheses (SMITH 1993, p. 7); I will adopt the convention of appending "-now" to present tense verbs where they are not to be understood tenselessly. So, the non-presentist claims that there are dinosaurs, but not that there are-now dinosaurs.

To put this another way, if we are to distinguish between tenseless sentences and their present tense analogues, we need a distinction between **grammatical tense** and **logical tense**. The belief in tenseless sentences is not grammatically revisionary. Grammatically speaking, the sentence "there are dinosaurs" is in the present tense. How it should be understood for the purposes of philosophical semantics is another matter.

This distinction, between tensed and tenseless senses of the grammatical present tense, excites opposition from many presentists. Presentists often underwrite their tensism but saying that tensed language cannot be analysed in terms of tenseless language because there is not any tenseless language in terms of which to do the analysis. This claim is stronger than tensism; I will call it **strong tensism** (and when I need to draw the contrast between strong tensism and the view described in the previous section, I'll call the latter **weak tensism**).

Though tensism is a semantic doctrine, it has important methodological consequences. It follows from weak tensism that philosophical semantics of tensed language must be done, if at all, in tensed language. And it follows from strong tensism, that all philosophy, including especially metaphysics must be done in tensed language.

6.1.2   Anti-realism

Anti-realism about the past and future (or anti-realism, as I will henceforth call it for brevity) is the doctrine that we should not be ontologically committed to anything past or future; or, more naturally, that there is not anything which is past or future.

The former, more clumsy formulation of this doctrine is needed because of the danger of presentists and non-presentists speaking past each other owing to confusions about tense. The question of ontology is often put thus: "What is there?" following Quine (1953). This question is normally taken to be a tenseless one. But if strong tenselessism is on the table, this cannot be assumed.

What should we take the question of ontology to be, by the lights of strong tensists? There are two possibilities, neither of which is satisfactory — both lead to presentists talking past their opponents.

First, it might be "What is there *now*?" — an explicitly present tense question. In that case, the ontological part of presentism is a trivial truth recognised by realists about the past and future. Of course there are only present things right now! But, as Mellor says, "authors who think that only what is present... exists are not peddling mere tautologies." (MELLOR 1998, p. 20)

Second, it might be "What is, was, or will be there"? — a disjunction of three tensed questions. This formulation has the opposite problem, because,

of course, now the presentist won't answer this question any differently to a realist about the past and future. Presentists admit that there *were* dinosaurs, and there *will be*, perhaps, nasally-installed computers; but these would be past and future things respectively, and cannot be things that a presentist believes that there are for the purposes of ontology.

A presentist can avoid this problem by rejecting strong tensism, continuing to hold weak tensism, and accepting that the question of ontology is a tenseless one. Then anti-realism becomes the doctrine that there is tenselessly nothing past or future. This is a very good reason for rejecting strong tensism. It is very clear that realists and anti-realists about the past and future disagree over something. However, there are no tensed sentences that the one holds that the other doesn't. It follows that whatever sentence(s) they are disagreeing over must be tenseless.

Though it seems to me that strong tensism is indefensible for the reasons given above, I don't wish to assume that point for the purposes of my other arguments here. To accomodate strong tensists, we can say that anti-realism is the doctrine that we ought not to be ontologically committed to past and future things, where the reasons why not are spelled out in some way that avoids the problems described above.

6.1.3   The presentist theory of persistence

It might seem that, given that presentists deny that there is anything past or future, they would simply deny that, strictly speaking, things persist. The presentist account of persistence is sometimes described in these terms, as in Lewis's "second solution" to the problem of temporary intrinsics (see section 4.2.2): " This is a solution that rejects endurance; because it rejects persistence altogether..." (LEWIS 1986, p. 204)

Lewis's comment is taken from a context in which "persistence" requires location at multiple times, however. The presentist theory of persistence is most naturally taken to be a theory on which multiple location is not a necessary condition of being a persisting object. If we grant presentists the resources required to make presentism a coherent position, presentists have a very obvious and natural sounding theory of persistence available to them. According to the presentist theory of persistence, an object persists iff it either did exist, or will exist.

In effect, a persisting object on the presentist theory is one that exists at

two times; both a past or future one, and the present one (since everything is at the present time, according to anti-realism about the past and future). Of course, a presentist will refuse this gloss, quantifying as it does over past and future times.

It is an important point, I think, that what I have described here as the "presentist theory of persistence" is not entailed by presentism, construed as the conjunction of anti-realism and tensism. For the moment I will not attempt to establish this — in section 6.5, however, I describe two variants on presentism, one of which combines a form of anti-realism about the past and future with an endurantist theory of persistence (section 6.5.1), and the other of which combines a realist ontology with a presentist theory of persistence (section 6.5.2). If these two theories are coherent, then presentism proper must be orthogonal to the presentist theory of persistence.

6.2   Replies

6.2.1   The Analogy with Space

Presentists standardly reject any analogy between time and space. the arguments they use are similar to those considered earlier (see section 5.2.1). Instead they claim that time should be understood on the model of modality. I will discuss analogies between time and modality in sections 6.3.1–6.3.3.

There is, however, a problem about how to make presentism compatible with relativistic physics. Given the relativity of simultaneity, it is not possible to pick out one set of events as the present independently of a choice of reference frame. But which frame shall we choose? (PUTNAM 1967)

There are two basic lines of reply to this problem. The first is to advance presentism as a piece of conceptual analysis of ordinary language — the folk theory of time — without intending to affirm or deny that theory. The claim then is not that the past and future do not exist, but that we speak as though they don't.

Alternatively, a presentist might choose the bold course of denying that current relativistic physics is correct. This could be done either as a part of a denial of scientific realism, or as part of a programme of naturalised metaphysics. To be slightly less bold, the presentist could claim only the relativistic physics is incomplete (which seems plausible) and that completed physics

will give us a reason to prefer one reference frame, rehabilitating absolute simultaneity.

6.2.2   The Problem of Change

Presentists also have an easy answer to the problem of change. Since objects do not have any properties other than those they have at the present moment, the arguments connected with the problem of change can get no grip.

The presentist replies to the semantic problem of change by endorsing analysis 15 (see page 63), and to the problem of temporary intrinsics by endorsing Lewis's "second solution": "the only intrinsic properties of a thing are those it has at the present moment. Other times are like false stories; they are abstract representations, composed out of the materials of the present, which represent or misrepresent the way things are" (LEWIS 1986, p. 203–204)

Lewis complains that this solution to the problem of temporary intrinsics involves the denial that things persist at all. As I understand presentism, however, it is not denying that things persist, but offering an analysis of persistence — that things persist iff they did, or will exist. Lewis's definition of persistence, which is intended to be neutral, in fact begs the question in favour of endurantism and perdurantism and against the presentist theory of persistence, as I mentioned above (section 6.1.3).

6.3   Arguments

The main argument for presentism that is independent of its treatment of puzzles concerning persistence consists of a series of analogies that presentists draw between time and modality (section 6.3.1), and between aspects of the language of time, and modal language (sections 6.3.2–6.3.3).

6.3.1   Metaphysical Analogies with Modality

The presentist's attitude to past and future times is very like the actualist's attitude to possible worlds. Actualists wish to continue using modal language, such as "It is possible that dinosaurs are warm-blooded" without being ontologically committed to possible warm-blooded dinosaurs. Presentists wish to continue using tensed language, such as "It was the case

that dinosaurs were warm-blooded" without being ontologically committed to past warm-blooded dinosaurs.

Actualism is a difficult doctrine to hold onto, given the types of semantical theory that are available for modal language. A standard strategy for actualists is to reconstrue seeming quantification over some merely possible objects — normally possible worlds, or possible situations — as quantification over objects that are clearly actual, but abstract. This strategy is called modal ersatzism, and the actual objects that play the role of possible worlds or situations are called ersatz possible worlds, ersatz possible situations. (LEWIS 1986)

A clear example of this is Peter Forrest's account of possible worlds as **world properties**. (FORREST 1986) Think about the property of being just the way the world actually is. Now if this property is perfectly ontologically respectable, then there seems no reason not to think that similar world properties that the world does not actually instantiate should also be ontologically respectable. In particular, there is no reason to hold that a property is itself not actual merely because it has no actual instance.

So, according to one version of modal ersatzism, merely possible worlds can be identified with these uninstantiated world properties. A world at which there are purple people-eating monsters is really the property of being a world containing at which there are purple people-eating monsters. If there were such a world, it would be a possible object, and actualism would be false. But that is no reason to be opposed to the property of being such a world.

An analogous move is possible with regard to times. Consider the property of being just the way the present time actually is. If this property is ontologically respectable, then very similar **time properties** that happen not to be instantiated by the present time are ontologically respectable. These properties are ways that the present time might have been. Among them, some are ways the present time was, and other are ways it will be. The former are ersatz past times, the latter ersatz future times. (BIGELOW 1996)

There is an important distinction which comes along with modal ersatzism that I should mention here. This is the distinction between the actual world, and actualised worlds. In the world-property ersatzism that I described, among the ersatz worlds is the property of being just the way the world actually is. This is the **actualised world**, or the **actual ersatz world**: the one among the ersatz worlds that is an actually instantiated property. It is merely one among many ersatz worlds. The **actual world**, on the other hand is the object that instantiates this property, and is the one and only

non-ersatz world. (Lewis 1986, pp. 137–138)

A similar distinction is needed for temporal ersatzism. We need to distinguish the present time from the property of being just the way that time actually is. The former is (according to presentism) the one and only time — the **present time**; the latter is the one ersatz time among many that is instantiated — the **present ersatz time**.

6.3.2   Syntactical Analogies with Modality

Presentists usually think that the appropriate model for tense is modal logic. Tenses should be construed as sentential operators, like the modal operators box ($\Box$ — often interpreted as "it is necessarily the case that") and diamond ($\Diamond$ — often interpreted as "it is possibly the case that").

The corresponding tense operators I will write as **F** ("it will be the case that"), **P** ("it was the case that"), **G** ("it will always be the case that"), and **H** ("it was always the case that"). **F** and **P** correspond to modal logic's $\Diamond$, asserting, as it were, that there is some future or past time at which the embedded sentence is true. **G** and **H** correspond to modal logic's $\Box$, asserting, as it were, that the embedded sentence is true at all future and past times.

(I say "as it were" in the above paragraph because of course any presentist is going to jibe at the quantification over past and future times involved in these explications. The English-language interpretations in parentheses, however, are presentistically respectable — or at least, they are according to presentists.)

Sentential operators are pieces of logical vocabulary that can modify both open and closed sentences — by contrast with predicate modifiers (which modify only open sentences) and statement operators (which modify only closed ones).[1]   So the mark of a feature of natural language that is best translated into logic as a sentential operator is that it is subject to scope ambiguities when used with quantifiers.

For example, consider the future tense English sentence

33 All human beings will have computers installed in their noses.

---

[1]I blur the distinctions between predicates and open sentences, and between statements and closed sentences here only to secure terminological standardness. I don't think these distinctions matter to the point I am making here.

Using "Px" for "x is a human being" and "Qx" for "x has a computer installed in his or her nose", which of 34 and 35 should be the translation of 33 into logic?

34 $\mathbf{F}(\forall x)(Px \supset Qx)$

35 $(\forall x)(\mathbf{F}(Px \supset Qx))$

34 and 35 have different truth conditions. 35 is only true if all present human beings survive until the invention and wide use of nasal computers. 34 on the other hand only requires that it will be the case that all humans being *then* in existence will have nasal computers installed.

The ambiguity between these two readings seems to exist in the English language sentence that they are intended to translate. This suggests that the way in which the tense of 33 interacts with the rest of the sentence is best understood on the model of a sentential operator (like the modal operators).

By analogy, therefore, presentists think we should treat the tense operators very much in the way that we treat modal, and other intensional operators:

> If I allege or believe that someone has stolen my pencil, there may be no specific individual with respect to whom I allege or believe that *he* stole my pencil. There is *alleged or believed to be* an individual who stole it, but there is *no individual who is alleged or believed* to have stolen it...

> [W]hat I am suggesting is that the sort of thing that we unquestionably do have with "It is said that" and "It is thought that", we also have with "It will be the case that" and "It was the case that". (PRIOR 1962, p. 12–13)

I will call this doctrine, that tenses should be understood as unanalysable sentential operators, **operator tensism**.

6.3.3   Semantical Analogies with Modality

According to many presentists, times play a similar semantic role to possible worlds. Times, like worlds, are the sort of thing at which sentences may be

true or false. A sentence might be true at one time, and not another. For example, "there are dinosaurs" is be true at some past times, but false at the present one.

Temporally relativised truth can be used — and is used, in model theory of tense logic — to give a semantics for the tense operators:

$\mathbf{F}\alpha$ iff there is a future time at which "α" is true.

$\mathbf{P}\alpha$ iff there is a past time at which "α" is true.

$\mathbf{G}\alpha$ iff "α" is true at every future time.

$\mathbf{H}\alpha$ iff "α" is true at every past time.

Here again we are slipping into quantifying over times, which might be thought to be dubious by presentist lights. However, the same dubiousness hangs over the quantification over merely possible worlds that is used to give the analogous semantics for the modal operators. In the modal case, a standard move is to say that the possible worlds being quantified over are the ersatz worlds discussed earlier (section 6.3.1). Similarly, presentists will wish to say, the times that are being quantified over here are ersatz times.

6.4   Problems

There's a simple, table-thumping objection to presentism which is, I think, in a certain sense the right objection. All subsequent objections to presentism can be presented as rejoinders to the presentist's response to this:

> The anti-realist about the past is in the same absurd position as someone who holds that God created the world *ex nihilo* in 4004 BCE, complete with fossils to test the faithful. Worse, she holds that I did not even begin this sentence! The anti-realist about the future holds that I will not thump the table in the next 5 seconds.... [Thump!] I refute her thus!

This is, of course, an unfair characterisation of what even the most minimally sophisticated philosophical presentists believe. An anti-realist about the past

does not have to hold that there were no dinosaurs, or no last Thursday, or no beginning of this sentence. All presentists that I know of want to reconstruct talk of the past in such a way that "There were dinosaurs 64 million years ago" comes out true, or at least assertable in a way that its negation is not, without there being any dinosaurs.

That is, the anti-realist about the past need not hold that "There were dinosaurs 64 million years ago" is false, but only that it carries no ontological commitment to past, mind-independent dinosaurs. A similar move will be made for future tense sentences. The anti-realist about the future need not deny "Australia will be a republic", provided that she denies that this sentence carries ontological commitment to a future, mind-independent, Australian Republic.

The presentist is writing a promissory note for a semantic theory that will deliver these implications about past and future tense sentences. Presumably that semantic theory will be given an analogous form to that of the possible-worlds semantics for modality, as discussed in section 6.3.3.

So far as I know, there are three possible moves that a realist can make at this point. First, the realist might try to think up more true sentences that seem to be committed to past or future entities, but which cannot be treated in the way the presentist proposes to treat "there were dinosaurs" and "Australia will be a republic" (I discuss this option in sections 6.4.1–6.4.3). Second, the realist might try to argue that the type of semantics the presentist proposes will not yield anti-realism about the past and future. I won't discuss this option directly, but it is implicit in my discussion of stage theory, which tries to take the presentist's treatment of tense and persistence, and combine it with a realist ontology of time (section 6.5.2). Third, the realist might try to argue that the proposed semantics of tense do not really answer the problem posed by the tablethumping objection given above (to be discussed in section 6.4.4).

6.4.1   Present-tense truths about the past and future

If the presentist can accept that past things did exist, and future things will exist, what exactly does she believe that's different from what the realist about past and future believes? For one thing, the presentist holds that though there were past things, and there will be future things, there *aren't* any of either.

Most ordinary talk about the past or future is couched in the past tense or the future tense. Ordinary past tense sentences about the past such as 36,

    36 Some dinosaurs were herbivores.

can be dealt with by the presentist's proposed semantics for the past tense. Suppose for the sake of argument, for the remainder of this section, that such a semantics exists, is plausible, and compatible with anti-realism about the past. No objection remains to the compatibility of presentism with 36.

Truths involving "is past" and "is future"

We do not always talk about the past and future in the past or future tense. Take for example,

    37 Some dinosaurs are past.

    38 Some nasal computers are future.

37 is certainly true. There were some dinosaurs, even the presentist will admit. But if there were some dinosaurs, and there are no longer, then those dinosaurs are past. The most natural reading of this proposition, even assuming operator tensism, is straightforward quantification over past dinosaurs, outside of the scope of a tense operator. And on a standard, quantificational view of ontological commitment, that makes 37 committing to dinosaurs.

Similar reasoning applies to 38. Supposing that there will sometime be nasally-installed computers, those computers are now future.

One answer to this is that the "natural reading" treats "are past" as an ordinary predicate, expressing an ordinary property of pastness, which may be a mistake. That way lies McTaggart's paradox. (MCTAGGART 1927, ch. 33) (See also appendix E on this point).

How else could we understand sentences such as 37? One way is to appeal to the distinction between grammatical and logical tense discussed earlier. Normally the logical tense of a sentence that contains a copula, as 37 does is determined by the tense of the copula, which is the main verb of the sentence. But perhaps in some cases, the remainder of the predicate can also make a contribution. "Past" could work like that, adding a past-tense operator with wide scope, so that the correct logical structure of 37 is the same as that of

39 There were some dinosaurs.

which, like 36, can be dealt with by the mechanisms we have granted the presentist.

Truths involving other predicates

Presentists sometimes express this point discussed above by saying "pastness is not a property". But it is not only the predicate "is past" that generates this problem. Take:

40 Some dinosaurs are dead.

A similar argument to that given above applies. If there were some live dinosaurs, and they were destroyed, they are now dead. They are not any less dead because they don't now exist — destroying a live thing is a way of killing it.

The trouble here is that there seem to be two ways of being dead. First, something can be dead by being a corpse — by being a body that is not alive. Second something can be dead simply by being past. The property of *being a corpse* is a perfectly ordinary qualitative property; so the existence of predicates like "is dead" that seem to be disjoin *being a corpse* and *being past* undermines the view that "pastness is not a property".

This is more of a challenge than an argument. My point is that the presentist's semantics are becoming more and more complicated — she owes us an account of the semantics of predicates seemingly unrelated to tense, such as "is dead". And this account must be more complicated than realists about the past need to give.

6.4.2   Proper names of past things

Another well-discussed problem for presentism involving present-tense truths about the past concerns proper names for past things. The classic example is:

41 Queen Anne is dead.

Of this Prior says:

> What we must be careful about here is simply getting our prefixes in the right order. Just as
>
> (1) I think that (for some specific X (X stole my pencil))
>
> does not imply
>
> (2) For some specific X (I think that (X stole my pencil)),
>
> so
>
> (3) It was the case that (for some specific X (X is called 'Anne', reigns over England, etc.))
>
> does not imply
>
> (4) For some specific X (it was the case that (X is called 'Anne', reigns over England, etc.)).
>
> On this view, the fact that Queen Anne has been dead for some years is not, in the strict sense of 'about', a fact about Queen Anne; it is not a fact about anyone or anything — it is a *general* fact. (PRIOR 1962, p. 15)

It is a bit unclear what Prior means by "general fact" here. In the case of my thinking that someone stole my pencil, is it the content of that thought, or the fact that I am thinking it, that is supposed to be the general fact? Prior must mean the latter — for it is only that way that the analogy with 41 (i.e. his (3)) goes through. Prior wants to say that "Queen Anne is dead" is a general fact because its logical structure is analogous to that of (1) and not of (2).

On the other hand, if we think pre-theoretically about the sense in which a general fact is involved in (1) and not in (2), it is only sensible to say that the content of the belief mentioned in (1) is general, while the content of the belief mentioned in (2) is not. There is no sense in which the fact that I believe that someone stole my pencil is a more general fact that the fact that there is someone of I believe that they stole my pencil. The difference between (1) and (2) is not to do with the type of fact they express, but to do with the content of the belief mentioned in each.

My point here is just that Prior's use of the term "general fact" is misleading. There is a kind of generality associated with (1) and not with (2), and it is

easy, when reading Prior's argument less than carefully, to think that Prior is suggesting an analogy between the generality of "for some specific X (X stole my pencil)" and "(for some specific X (X is called 'Anne', reigns over England, etc.)". But that cannot be what he means. Prior is trying to show that it is (3) *as a whole* that is "general", not that the part of it inside the scope of the tense operator is.

Prior's Russellian solution

With all the confusions about general facts out of the way, there is still a residual point to Prior's argument: it does not follow from the fact that the name "Queen Anne" is used meaningfully that Queen Anne exists. This is the familiar point about the existence of empty names. Everyone needs to believe in empty names: "Pegasus", and so on. Prior's point is simply that the analysis classically used to avoid commitment to Pegasus and friends work equally for the names, like "Queen Anne" that presentists believe to be empty.

That analysis is Russell's theories of definite descriptions and ordinary proper names. Prior's real solution to the puzzle of "Queen Anne is dead" is simply to treat "Queen Anne" as a Russellian ordinary proper name — equivalent to some description, which Prior has rendered as "called 'Anne', reigns over England, etc."

The view that the names of historical personalities such as Queen Anne are Russellian proper names, while unexceptionable in Prior's day, is now thoroughly controversial. Without wanting to get too deeply into the debate about description theories of names and of meaning, I'll mention briefly the problem I take to be particularly troublesome for Prior's approach. This is Kripke's **problem of error**.

In Kripke's example, we imagine that we have figured out the description abbreviated by the name "Gödel", and that it is "the man who discovered the incompleteness of arithmetic".

> Suppose that Gödel was not in fact the author of this theorem. A man named 'Schmidt', whose body was found in Vienna under mysterious circumstances many years ago actually did the work in question. His friend Gödel somehow got hold of the manuscript and it was thereafter attributed to Gödel. On the view in question, then,

> when our ordinary man uses the name 'Gödel', he really means to re-
> fer to Schmidt, because Schmidt is the unique person satisfying the
> description, 'the man who discovered the incompleteness of arith-
> metic'...
>
> So, since the man who discovered the incompleteness of arithmetic
> is in fact Schmidt, we, when we talk about 'Gödel', are in fact always
> referring to Schmidt. But it seems to me that we are not.
> (KRIPKE 1972, p. 83–84)

Kripke's point is that, even if we could find a description that uniquely applies
to Gödel, the name is not vulnerable to error in the way that the description
is. They cannot, therefore, be semantically equivalent. Prior's treatment of
"Queen Anne" suffers from the same problem. If it turned out that Queen
Anne did not satisfy the description Prior offers, and that someone else did
satisfy it, then we would still refer to Queen Anne by the name "Queen
Anne", and not that someone else.

If Queen Anne did not rule over England, etc. but someone else did, it would
be false to say "Queen Anne ruled over England". It would still be true to
say "The person who ruled over England, etc., ruled over England", so the
name and the description cannot be equivalent.

This shows, I think, that Prior's treatment of names of past things as empty
Russellian ordinary proper names is inadequate. But the Russellian treat-
ment is not the only one available. It is much more plausible, on the assump-
tion of presentism, to think of names like "Queen Anne" as empty logically
proper names.

A free logical solution

This requires that the normal inference rule of existential generalisation,
$Pa \vdash (\exists x)(Px)$ be invalid. For if a could be an empty name, we would not
want to infer that anything has the predicates that may be truly applied to
it. For example, if a means the same as "Pegasus" and P means "does not
exist", we would not wish to infer falsehood "Something does not exist" from
the truth "Pegasus does not exist".

Presentists would be best advised, I think, to take up a free logic. These are
logics where the inference described above is blocked. Existential generalisa-
tion is restricted, one way or another, to non-empty names. There may be

both true and false subject-predicate propositions in such a logic. For example, if a means the same as "Pegasus", and Q the same as "flies", it might be true to say Qa and false to say $E!a$ (where $E!$ is the existence predicate). (LEBLANC AND HAILPERIN 1959; SCHOCK 1968)

This means that it can be straightforwardly true that Queen Anne is past, or dead, or whatever, without it following that there are any past things.

While these logics are syntactically very attractive, the difficulty with them lies in giving an adequate semantic account of them that does not, itself, quantify over things that are non-existent from the point of view of the object language. What is it about the empty name "Pegasus" that makes it the case that "Pegasus flies" is true, while "Pegasus does not fly" is false? To go back to the case in point, what is it about the empty name "Queen Anne" that makes it the case that "Queen Anne is past" is true, while "Queen Anne is future" is false?

It had better not be that there is something non-existent which is Queen Anne and is past; not just because this violates Quinean dogmas about existence, but because it also violates anti-realism about the past, which as I have construed it, is the doctrine that there is not anything past.

Free logic comes at a price, but it is a price that the presentist must be prepared to pay — for the same problems afflict operator tensism. Just as it is hard to have free logic without non-existent objects, it is hard to have tense logic without past and future objects. Even on Prior's proposal to treat empty names as descriptions, Russell-style, there is the same puzzle. What it is about the empty description "is called 'Anne', reigns over England, etc." that makes it the case that it *was* the case that something satisfied that description, but not that it *will be* the case that something satisfied that description?

So, though free logic is certainly problematic, it is not more so than tense logic already is. Since, at this stage, I am granting that the presentist can supply a semantics for tense logic that is compatible with anti-realism, I should grant them a semantics for free logic as well. It may be thought that I am being more than generous in doing this; a point which I will discuss in section 6.4.4.

6.4.3   Relational truths about past or future things

Presentists have often worried about relational truths that ascribe a relation between non-contemporaries. For example:

42 Colin Powell is not as good a strategist as Julius Caesar.

Here again we have a present-tense sentence that seems to refer to a past object.

Disturbingly (for the presentist) this present tense sentence seems as though it ought to be equivalent to a past tense sentence:

43 Julius Caesar was a better strategist than Colin Powell.

It is hard to see how either sentence can be true by presentist lights, either in our day or in Caesar's, because Caesar and Powell have never been contemporaries.

Pretence solutions

As we found in the previous section, there is a sense in which everyone must deal with this problem. We often ascribe relations between existing things, and fictional objects or persons. There has been some lively discussion in the literature on truth in fiction on this topic. Mark Crimmins offers a standard analysis:

> I might say:
>
> (2) The degree of cleverness and the degree of modesty that actually are such that in the Sherlock Holmes stories there is portrayed there being a person named 'Holmes' with that degreee of cleverness and there being a person named 'Watson' with that degree of modesty, are such that Ann's degree of cleverness is comparable to the former, and her degree of modesty is greater than the latter.
>
> While perspicuous, that takes a long time to say, it is not easy to follow, and one needs considerable conceptual sophistication to formulate or understand it. What I actually say, of course, is:

(3) Ann is as clever as Holmes and more modest than Watson.
(CRIMMINS 1998, p. 3)

The presentist could take a similar approach. Perhaps what we mean by 42 is something like 42', and what we mean by 43 is something like 43':

42' D, the degree of ability in military strategy that is such that Julius Caesar displayed D, is such that Colin Powell's degree of ability is less than D.

43' E, the degree of ability in military strategy that is such that Colin Powell displays D, is such that Julius Caesar's degree of ability is greater than E.

In these paraphrases, the name "Julius Caesar" is never used outside the scope of a past tense operator, and the name Colin Powell is never used inside the scope of such an operator. There is a cost: we must accept degrees of military strategy into our ontology, and they must exist at every time (or in more presentist-friendly language, they must always have existed).

Causation

Some relational present-tense truths about the past and future cannot be given the analysis described above. This is especially the case where the relation concerned is an intrinsic relation, in the sense of section 2.1.9.

Presentists who believe that causation is an intrinsic relation are sometimes forced to say that it holds only between contemporaries. John Bigelow, for example, claims that

> At any given time the causal relation holds between properties... each of which is present and is presently instantiated. These properties may include things like the property of being burdened with a certain sort of past, or (as Leibniz put it) pregnant with a certain sort of future. (BIGELOW 1996, p. 47)

The cause of, for example, a match's now having the property *being alight* might be regarded as the match's now having the property *having been struck*.

This latter property has to be understood in a way that makes a match's having it compatible with the non-existence of the past. I am not sure that there is any such way; but supposing that there is, my point still stands. An anti-realist about the past may be able to give *a* causal explanation of the match's being alight, but cannot give the causal explanation we do give in our scientific and ordinary practice, in terms of a past striking of the match (or in terms of any past event).

It seems to me that Bigelow's proposal stretches the boundaries of what we mean by "causation" too much. However, this is to get into metaphysical problems for presentism, and for the moment I want to restrict myself to the merely logical problems.

6.4.4 Truthmakers for Past/Future Tense Sentences

In the foregoing sections 6.4.1–6.4.3, I have been assuming that the presentist's strategy of appealing to the semantics of tense to block the table thumping objection of section 6.4 is legitimate. However this is a point that is not usually granted by realists about the past and future. A more normal reply to the presentist is to insist that the point of the table-thumping objection was not to ask for a semantic theory of the truth of past and future tense sentences, but rather a metaphysical theory — the realist wants to know what the **truthmakers** for truths about the past and future are.

Though this objection to presentism has wide appeal to realists about the past and future, it can be hard to say exactly what it amounts to. In order to get a clearer idea of what the request for truthmakers means, I think it is best to put it in the context of a specific theory of truthmakers.

According to the theory I introduced in section 2.1.3, a proposition p is made true by an object x iff x is intrinsically such that p is true. That is, it is impossible that p not be true, and x have just the intrinsic nature that it actually has. Let us call this **strong intrinsic truthmaking**.

A weaker, but related conception — the one defended in (PARSONS 1999) and (PARSONS 2001B) (reproduced as appendices A and B) — puts it counterfactually: were p not true, x would have a different intrinsic nature from the one it actually has. In effect this replaces what is a strict implication in the stronger formulation with a would-counterfactual. Call this **weak intrinsic truthmaking**.

The difference between strong and weak truthmaking reflects an issue about whether we should think of the connection between a proposition and the kinds of thing that would make it true as necessary or contingent. In turn, this is connected with what propositions are. If propositions are imagined to have their truth conditions essentially (as is usually the case), then the strong conception of truthmaking will be appealing, because such a proposition, if true, could not fail to be made true by a duplicate of its truthmaker.

On the other hand, if propositions have their truth conditions contingently, then the weak conception will appeal: a proposition could fail to be made true by a duplicate of its truthmaker, if that proposition had different truth conditions to those it actually does. In (PARSONS 1999) I identified the propositions with sentence tokens of ordinary language, which is why I preferred the weak conception there. For the sake of simplicity, though, here I will use the strong conception. I don't think it will affect the argument against presentism.

The argument

Realists about the past and future have no problem coming up with truthmakers for propositions about the past and future. Past and future objects will do. Take the truth "there were dinosaurs". The realist about the past can say that past dinosaur lineages are the truthmakers for this propositions. If there had not been dinosaurs, those lineages would have had to be different in some intrinsic respect — by being so much more like their non-dinosaur ancestors than they actually are, so that they would not count as a dinosaur lineage, perhaps — or by not existing at all.

To put things more simply, the realist about the past can say what would be different about the world as a whole, had the proposition "there were dinosaurs" been false. The anti-realist about the past has a very hard time answering this question.

I have no proof that it is impossible for a presentist to supply an answer to the question. But it is possible to taxonomise the available answers in a way that makes them all look unattractive.

The general no truthmakers answer: "Why do we need to believe in truthmakers for true propositions at all? Isn't it the case that even the best

truthmaker theorists have trouble coming up with enough truthmakers for every true proposition? We're no worse off than anyone else."

There is a reason that truthmaker theorists try to come up with truthmakers for every true proposition: it seems to make sense to ask "What is it about the world that would be different, were the proposition p false?" And it does seem natural to think that something is remiss with an alleged truth for which this question has no answer. Truthmaker theory hits the nail squarely on the head for theories that involve such truths: Rylean behaviourism about the mental; if-thenism about mathematical truth.

Moreover, the admitted troubles in coming up with truthmakers for every true proposition all fall into one of two categories. First, propositions such as "All ravens are black", where, were the negation of this proposition true, there would be no problem about its truthmaker. Problematic propositions of the first kind all have either truthmakers or falsemakers. Second, propositions such as "Either all ravens are black, or some cockatoo is purple", which might have neither truthmakers nor falsemakers,[2] but which are boolean combinations involving the propositions of the first kind (in this case, "All ravens are black").

By contrast, however, the problem for presentists involves a whole domain of discourse. "All dinosaurs were cold-blooded" "Some dinosaurs were warm-blooded", and "Either all dinosaurs were cold-blooded or some dinosaurs were herbivorous" are all in the same boat. Realists about the past may have the standard trouble with the first and third of these, but a presentist has the same problem with all three.

The specific no truthmakers answer: "It's appropriate to ask for truth-makers for the truths of some domains of discourse, and not for the truths of other domains. It's precisely because presentists are anti-realists about the past that they don't need to believe in truthmakers about the past."

This suggestion adds another plank to presentism, along with tensism and

---

[2]Suppose all ravens *are* black, and no cockatoo is purple. Were the proposition in question false, it might be that nothing that actually exists would be any different from the way it actually is, because there could be an extra non-black raven which does not actually exist. So the proposition has no truthmaker. Now suppose there is a non-black raven, and, as before, no purple cockatoo, so that the proposition's negation is true. Were the negation false, it might be that nothing that actually exists would be any different from the way it actually is, because there could be an extra purple cockatoo which does not actually exist. So the original proposition has no falsemaker either.

anti-realism about the past and future: anti-realism about truthmakers for propositions about the past and future. The former kind of anti-realism does not entail the latter, however (as we will see in the following two answers to the truthmaker question for presentists). So a presentist, where presentism is the doctrine described in section 6.1, is not forced to be an anti-realist about truthmakers for propositions about the past and future.

The presentist, therefore, stands in need of a non-question-begging reason for giving this answer to the truthmaker question, rather than a general denial of truthmaker theory. That is, the presentist needs to explain why discourse about the past and future is deficient in this way, when discourse about the present is not.

At the same time, however, the presentist needs to hang onto the idea that past and future tense talk is not in any sense second class discourse, or not really true — because the presentist needs to answer the table-thumping objection of 6.4.

The trace answer: "Propositions about the past and future have truthmakers; but the truthmakers are those one would associate with the propositions about the present that epistemically verify the propositions about the past and future. The truthmakers for 'there were dinosaurs' are dinosaur fossils."

This type of presentist is a Dummettian T-type anti-realist about the past and future (i.e. one who is a Dummettian anti-realist about the past and future, but a realist about the present). (DUMMETT 1969, pp. 366-367) There are two problems with this view:

First, there is the same problem as with the specific no truthmakers answer: the presentist needs to hold that propositions about the past and future are not true only in a deficient or second-class sense. But how else can a distinction between domains of discourse of which verificationism is true, and domains of which it is not be justified?

Second, the hypothesis of radical deception about the past or future (for example, if God created the earth in 4004 BCE complete with misleading evidence) does not seem incoherent. But it would have to be if we were verificationists about propositions concerning the past and future. Perhaps these hypotheses would seem incoherent to someone with more sympathies for verificationism than myself; but at least they should still seem *no more*

incoherent than other types of radical deception hypothesis — brain-in-a-vat scenarios for example.

The ersatzist answer: "Propositions about the past and future have truthmakers; but the truthmakers are those one would associate with propositions about certain kinds of presently existing abstract objects, or arcane properties of presently existing concrete objects."

For example, it might be thought that talk about past and future things is really talk about past and future ersatz times, in the sense discussed in section 6.3.1. Recall that there I considered the identification of past and and future times with uninstantiated time properties, ways the present time might have been. Of these, some will be such that, were they instantiated, there would be dinosaurs (call this class D). What makes it true that there were dinosaurs, it will be said, is that one of the members of D has the second order property of *having been instantiated*.

Abstract and arcane indeed! But, as I argued in section 6.3.1: nominalistic worries aside, there is nothing ontologically unrespectable about these properties. My objection is not to the properties but to the strange things that presentists have to believe about them. For here is where I think the truthmaker argument is at its strongest.

Call the time property of *being such that there are dinosaurs* P, and the second order property *having been instantiated* $\mathfrak{I}$. What makes it true that P has the property $\mathfrak{I}$? Realists about the past will think that $\mathfrak{I}$ is an extrinsic property, because whether P has it depends on whether there are past dinosaurs; the dinosaurs themselves being wholly distinct from the property P. So the realists can say that the dinosaurs make this proposition true.

But according to the presentist, there's nothing more to say than that P has $\mathfrak{I}$. Certainly, P's having $\mathfrak{I}$ does not concern the intrinsic nature of anything apart from P and $\mathfrak{I}$ themselves. If the proposition that P has the property $\mathfrak{I}$ has a truthmaker at all, then, it must be P itself, and $\mathfrak{I}$ must be intrinsic to P. But it seems bizarre to believe that this should be the case — that the intrinsic nature of a property should depend on whether it is instantiated.

Past and future facts as dispositions

A proposal which, I think, puts the best slant (from a presentist point of view) on the difficulties about truthmakers I have been discussing is that

which assimilates propositions about the past and future to another type of proposition where it has seemed that truthmakers may be lacked: propositions about dispositions.

In (PARSONS 2001A), (reproduced as appendix E), I suggest that if the A-theory of time were true — that is, if pastness, presentness and futurity were intrinsic properties of times (called A-properties) — then it would be natural to analyse the past and future tenses in terms of what would have been, were a time that is actually past or future present. For example, "Caesar was bald" is given the analysis "There is a past time t, such that if t were present, Caesar would be bald." This analysis gets the right answer for iterated tenses: "Caesar was future" comes out as "There is a past time t, such that if t were present, Caesar would be future."

We could think of these counterfactuals as expressing dispositions. Caesar is not in fact bald now. But he has the unactualised disposition to be bald, were only the right time present.

It takes a little work to make this idea compatible with presentism. There is the problem that the analysis quantifies over past and future times; but perhaps these can be replaced with ersatz past and future times. And then there is the problem that the proposed analysis of "Caesar was bald" does not eliminate Caesar. To deal with this, we should analyse past and future tense sentences in two steps: first, replacing talk of past or future objects (such as Caesar) with world properties, then applying the counterfactual / dispositional analysis recommended above.

So

   44 Caesar was bald.

becomes

   45 The world had the property of *being such that Caesar is bald.*

which in turn becomes

   46 There is an ersatz time t, such that, were t present, the world would have the property *being such that Caesar is bald.*

which is to say

> **47** There is an ersatz time t, such that the world has the a disposition to
> be such that Caesar is bald, which would be actualised were t present.

There is a tradition of worries about whether propositions asserting that an
object possesses an unactualised disposition can be really, non-deficiently,
true. In Dummett's famous example: whether a person who dies without
having been in danger can be truly said to be brave. (DUMMETT 1963, p.
148) The truthmaker problem for presentism could be seen as a variant of
that problem, if the presentist is prepared to accept the dispositional analysis
of the past and future tenses I described above.

6.5   Variants

I consider two variants on presentism. The first combines the presentist's
doctrines about the unreality of the past and future with endurantism (sec-
tion 6.5.1); the second combines the presentist theory of persistence with
realism about the past and future, and a temporal parts ontology (section
6.5.2).

6.5.1   Presentism with Endurance

Thus far I have been assuming that presentists are anti-realists about the
past and future, in that they deny the existence of anything past or future.
They might instead be anti-realists about the past and future in a weaker
sense: they might deny the existence of anything that is not present. These
two can come apart if any of the things that presently exist also exist at past
or future times. Such things would have to endure; if they perdured they
would have to have parts that were past or future without being present, and
no presentist could believe in those.

To put this another way, there is a distinction between presentists who hold
that objects are are like three-dimensional time-slices of a perduring universe
(these presentists have more in common with perdurantists); and those who
hold that objects are four-dimensional enduring things, but that only present
enduring things exist.

What is going on here? Recall the distinction made in section 6.1 between the three doctrines involved in presentism: tensism, anti-realism, and the presentist theory of persistence. It is possible to believe that there is only that which presently exists; and also think that to persist is to be multiply located in time — that is, it's possible to combine a presentist ontology with an endurantist theory of persistence. This type of presentist will say that to persist is to be extended in time, just as the endurantist does (see section 5.1).

It might be objected that endurantism requires quantification over past and future times, which the presentist cannot countenance. This is a familiar problem, however, and can be solved by the usual mechanism of ersatz times (see section 6.3.1).

Though I think it is an important point that a presentist has a choice of theories of persistence available to her, I do not think that this variant is particularly more defensible against the problems raised in section 6.4, so I will leave it here.

6.5.2   Stage Theory

In the previous section I described how presentism can be combined with a theory of persistence not normally associated with it — the endurantist theory. In this section, I show that presentism and the presentist theory of persistence are completely orthogonal: it is possible to believe the latter while rejecting presentism.

Such a position has been clearly defended in the literature by Ted Sider. He calls this view **stage theory**. Sider also claims that early perdurantists such as J.J.C Smart held stage theory (SIDER 1996A, p. 433n) (compare my comments in section 4.3.1).[3]

According to stage theory, ordinary things are singly located at one durationless time: the present. (SIDER 1996A, p. 433) These things however, persist, and do so in virtue of there being other, past and future, times, at which past and future things are located. It's the existence of a past thing, bearing a special relation — the "I-relation" — to a a present object that

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[3]In the specific case of Smart, while he may have been a stage theorist in 1959, as Sider claims, he was clearly a perdurantist by 1963, when he wrote "It is perfectly possible to think of things and processes as four-dimensional space-time entities." (SMART 1963, p. 133) Armstrong, however, seems to have blurred the two as late as 1980, as I noted earlier.

makes it the case that that object *did* exist. Such an object is the present thing's **former stage**. Similarly, it's in virtue of there being a future thing I-related to x — a **later stage** — that x *will* exist. (SIDER 1996A, p. 437)

Finally, and most importantly, stage theory endorses the presentist theory of persistence: "the stage view does not rule out persistence through time, for... the stage view allows that I both exist now and *previously* existed in the past." (SIDER 1996A, p. 446) Sider's idea is clearly that something persists iff it either did exist or will exist (c.f. section 6.1.3).

Like presentism, stage theory thinks of time and tense on the model of modality and modal language, rather than on the model of space and spatial indexicals. However, the model is not the way most philosophers treat modality, but David Lewis's modal realism and counterpart theory. (LEWIS 1986) In Lewis's theory of modality, ordinary things are regarded as being **world-bound individuals**, and *de re* modal truths about some individual x are explained in terms of the simpliciter truths about a merely possible individual bearing a special relation — the **counterpart** relation — to x. The I-relation plays the same role in stage theory that the counterpart relation plays in counterpart theory.

Stage theory thus has a lot going for it:

- It can take over many of the arguments for presentism that work by arguing for an analogy between time and modality.

- It can use the well worked out formal structure of counterpart theory.

- It can answer problems about truthmakers by appealing to the existence of past and future stages.

But it has some problems:

Two kinds of persistence?

Sider notes that he believes that there are perduring objects — "worms", as he calls them. (SIDER 1996A, p. 433) It's just that they are not the everyday objects of our experience. Nor is this belief on his part accidental — it is forced upon him on him by his acceptance of classical mereology. If I persist by the lights of stage theory, then there are past or future stages of me. The fusion of all those stages is a worm. In fact, it is what a perdurantist would

claim to be the worm that is me. Classical mereology requires that there is such a fusion; and since I have argued for this feature of classical mereology on independent grounds (see section 3.3.2) I have an argument that every stage theorist should believe in worms.

Now the problem: do worms persist? Either way the stage theorist answers this, there is trouble.

Suppose the answer is no. This just seems bizarre. If there is anything that is multiply located in time (and appropriately causally unified) what could be lacking from it in virtue of which it does not persist? My doubts about perdurantism are doubts about the ontology of temporal parts (see sections 5.2.1, 5.2.2, and 5.5.1). But the stage theorist accepts that ontology.

Suppose the answer is yes. Then there are two ways to persist: by having an earlier or later stage, and by perduring. This also seems odd, because persistence doesn't seem to be an equivocal concept.

Notice that this problem does not arise for counterpart theory in modality. The counterpart theorist, for the same reasons as the stage theorist, is committed to **modal continuants** — trans-world individuals that are the fusions of an object with all its counterparts. However, it costs the counterpart theorist nothing to accept that the modal continuants, and not ordinary world-bound objects, are the things that modally persist — because the counterpart theorist is not committed to the claim that ordinary objects modally persist. What the counterpart theorist is trying to capture is *de re* modality, not any modal analogue of persistence.

The stage theorist, on the other hand, is trying to capture the commonsensical idea that ordinary objects persist. So it is problematic that the worms persist in a way that seems strikingly different to the way that ordinary objects are alleged to, according to stage theory.

Tense logic and the Temporal Barcan formulae.

Another problem for stage theory concerns the formal semantics of tense that stage theory might like to help itself to. I said above that stage theory, like presentism, trades on analogies between time and modality. This would suggest that a stage theorist could help herself to the machinery of tense logic worked out by presentists. However, this is by no means so simple as might appear.

The problem concerns the status of the tense logical analogues of the Barcan formula:[4]

$BF_{\mathbf{F}}$ $\mathbf{F}(\exists x)(Px) \supset (\exists x)(\mathbf{F}Px)$

$BF_{\mathbf{P}}$ $\mathbf{P}(\exists x)(Px) \supset (\exists x)(\mathbf{P}Px)$

For the sake of simplicity, I will discuss the future tense version of this formula, $BF_{\mathbf{F}}$. Reading it in ordinary language, "if it will be the case that there is an x such that x is P, then there is an x such that it will be the case that x is P." Tense logicians normally think that this formula is invalid. (Prior 1957, p. 27–28) To see why, consider interpreting P as "is a president of Australia": "if it will be the case that there is a president of Australia, then there is someone who will be the president of Australia." It does not seem that it should follow from the supposition that Australia will one day be a republic that its future president has already been born.

The plausibility of the Barcan formula is connected with the interpretation of quantifiers. In modal logics that validate it, the validity of the Barcan formula suggests that the quantifiers contained in it are possibilist, ranging over all possible objects. Similarly, in tense logic, the rejection of the Barcan formula corresponds to the rejection of tenseless quantification that is widespread among tense logicians.

It seems to me that the stage theorist should accept the temporal Barcan formulae as valid. If there will be a president of Australia, even if she is not born yet, then there is a future stage of the world that has a president of Australia as a part. So there is a person who will be the president of Australia.

This shows that the tense logic that the stage theorist wants is not of the standard kind used by presentists. It is not too problematic to construct a tense logic that validates $BF_{\mathbf{F}}$ and $BF_{\mathbf{P}}$ — but it is not clear that such a treatment would be preferable to the type of tenseless semantics for tense described in section 6.1.1.

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[4]For a discussion of the formalities of the Barcan formula in quantified modal logics, see (Hughes and Cresswell 1968, pp. 143, 170, 173–174)

Chapter 7

Conclusion

7.1 Review of the options

What then, is persistence? To answer this question, let's begin by reviewing the available options. The most fundamental divide between the theories I have considered concerns whether persistence is anything at all like extension in space — are persisting objects located at multiple times (as opposed to only at one instant)?

If the answer to this question is no, then we must prefer presentism. If yes, then we have a choice between perdurantism and endurantism. This choice concerns whether persisting objects have temporal parts (See figure 7.1).

We have learned, however, that things are not so simple. The presentist theory of persistence, I argued in sections 6.1.3 and 6.5, does not entail the presentist ontology of anti-realism about the past and future. So there seem to be two further options if we answered "no" to the first question. Supposing that persistence is not a matter of multiple location, it is still an open question whether objects persist in virtue of what is going on at other, past or future, times, or not. If we would prefer to think of persisting as a matter, not of being multiple located, but of having later or earlier stages, we can believe in persistence without being presentists — by being stage theorists (see section 6.5.2). So let's add the question "Do objects persist in virtue of there being other objects, located at past or future times?" to the tree in place of "Presentism".

Similar additions will have to be made under "Endurantism" and "Perduran-

Are persisting objects
multiply located?

Yes   *No*

Do persisting objects have
temporal parts?

                                     Presentism
                                       (chapter 6)

Yes   *No*

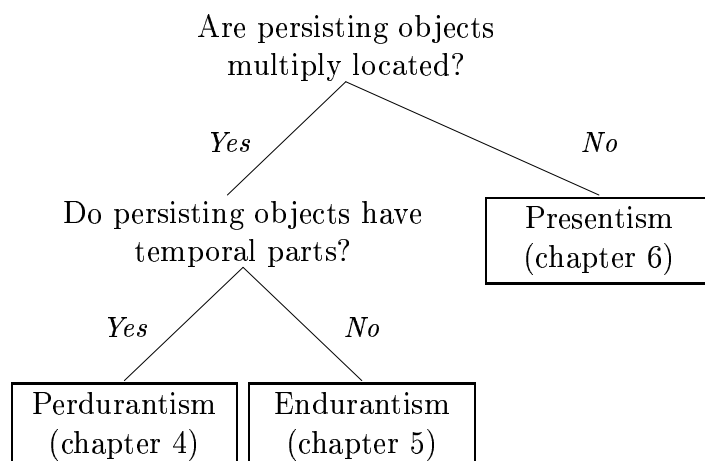Perdurantism   Endurantism
(chapter 4)   (chapter 5)

Figure 7.1: Simple decision tree for theories of persistence

tism". Supposing all persisting objects have temporal parts, are there any further criteria that must be satisfied for an object to persist? Armstrong's two gods argument might suggest that the answer to this question is "yes" (see sections 4.2.3 and 4.4.1). If we are convinced, we should prefer a form of 'strong perdurantism' to perdurantism proper. On the other hand, we might be convinced by Lewis's Humean argument that strong perdurantism buys us nothing.

I discussed "strong endurantism", or the view that everything that persists endures, only briefly, as it seems particularly problematic to me. Even those authors who seem closest to endorsing strong endurantism (such as Mellor — see section 5.3.1) often turn out to be endorsing it only for a restricted domain. In Mellor's case, this the domain of changeable things, such as persons, as against non-changeable processes or histories. Strong endurantism also seems unable to cope with the possibility of objects changing their parts (see section 5.4.1). Nevertheless, it is worth adding it to the picture as well. The complete tree of available theories of persistence is shown in figure 7.2 on the facing page.

7.2   What is persistence?

The theory of persistence I prefer is a form of mixed endurantism, of the kind discussed in section 5.5.1. I will now explain why this is. I will not be introducing any new arguments here, simply calling attention to those parts of earlier chapters that I regard as decisive.
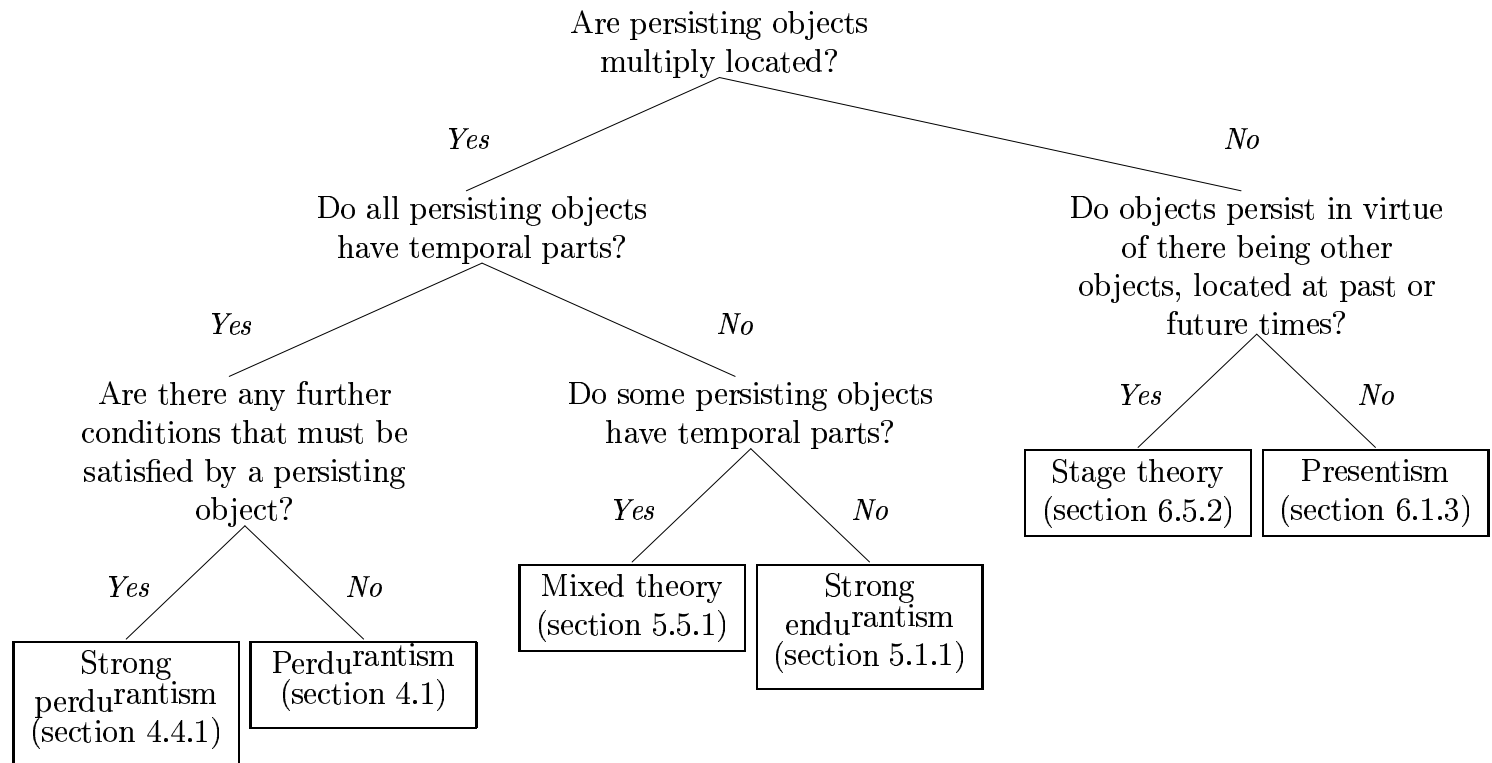
Figure 7.2: Decision tree for theories of persistence

7.2.1 The rejection of presentism

Presentism proper faces what I regard as insoluble problems. These are the argument for the analogy with space based on special relativity (sections 4.2.1 and 6.2.1), and the problems in coming up with plausible truthmakers for any past or future tense sentences (section 6.4.4). Presentists are not very much motivated to deal with these problems, I think, because they think of presentism as being close to a truth of logic. That is, they tend to think of the driving idea of presentism as tensism, and the related tense-logical treatment of the language of time (section 6.1.1). They are apt to respond to puzzles of the kind that I think decisive by showing that the puzzles cannot be stated in tensed terms, and must therefore be pseudo-problems. Here they rely on strong tensism — the doctrine that the only intelligible language there is is tensed. But strong tensism is false as an empirical claim about language, because it entails that presentists and non-presentists are not disagreeing about anything, when it is obvious that they are (section 6.1.2).

Stage theory can deal with all the problems described above. It is not committed to an absolute present, so is not incompatible with special relativity; and it can advance past and future things as truthmakers for past and future tensed truths. Though a stage theorist should believe weak tensism, there is no reason for her to be committed to strong tensism.

However, since the stage theorist should believe in perduring things, she faces a difficult task explaining why these are not the paradigm persisting objects. Stage theorists like to point out the analogies between their position and the well worked out theories of presentism on the one hand, and counterpart theory in modality on the other. But these analogies are overstated. The stage theorist will need a revisionary version of tense logic; and the analogy with counterpart theory breaks down because counterpart theorists are precisely those people who *deny* that ordinary objects modally 'persist' across worlds (section 6.5.2).

So presentism is in bad trouble, and stage theory is unattractive. We should think of persistence as involving objects being multiply located in time.

7.2.2 The rejection of perdurantism

Perdurantism is in much better shape than presentism. I doubt however that there are as many temporal parts as perdurantists believe in. In order for every persisting object to perdure, every persisting object would have to have

infinitely many proper parts, and there is quite simply no reason to suppose that this is the case (sections 3.5.2, 5.2.2).

Moreover, perdurantism denies the distinction between substantial and merely intrinsic change (sections 5.2.1, 5.5.1), as if every intrinsic property were an essential property (see also appendix A).

These problems are bad enough, I think, that we should be worried about the validity of the problem of change, used as an argument for perdurantism. Perdurantists are right that perdurantism explains why intrinsic change is possible in the light of the problem of change; but because of the problems described above, we should not regard perdurantism as clearly the best explanation. It seems to me that the best explanation should be given in terms of distributional properties (section 5.2.4), which is neutral with regard to perdurantism and endurantism. (See also appendices C and F).

Perdurantism is on the right track, but too strong. We would do best to settle for a generalisation of perdurantism to a mixed theory which allows that things persist either by perduring or enduring (section 5.3.2).

7.2.3   The rejection of strong endurantism

Should we go further, and deny that anything perdures? No; Armstrong's two gods argument shows that, given classical mereology (section 3.1) and the reality of past and future times, perdurance is possible (section 4.2.3).

Or should we deny then that perduring things persist? I think not; once we admit that there are perduring things, any residual resistance to the claim that they persist is likely to be the result of the assumption that all persisting fusions of person stages are persons, and *mutatis mutandis* for other sortals in the place of "person" (section 4.3.2). Once this assumption has been exposed, there is no barrier to claiming that the strangest scattered perduring objects persist.

It might be thought that the form of endurantism I have reached in answering "No" to both the questions above is wishy-washy or indistinguishable from perdurantism. On the contrary, my reasons for rejecting perdurantism require that perdurance take place only under very restricted circumstances: when an object undergoes a substantial change, in the sense described in section 5.5.1. And it is an important truth that objects endure though mere intrinsic changes (section 5.2.4).

The resulting theory of persisting is, to the best of my knowledge, a novel one. But it should be appealing to people who are currently moderate endurantists and perdurantists. Both of these groups are motivated by the need to retain a distinction between mere-Cambridge and not-mere-Cambridge change: both the problem of change, and the "essential temporality of change" argument are premised on this distinction. My novel move simply takes this one step further. The distinction between intrinsic and extrinsic change is only part of the story about real change; the remainder is the distinction between substantial and mere-intrinsic change, and in order to maintain it we need both perduring and enduring entities.

Part III

Appendices

Appendix A

Truthmakers

Because the notes to this appendix are quite lengthy, I have gathered them at the end of the appendix, rather than placing them at the foot of the page they belong to.

A.1 The Truthmaker Argument

In his two recent books on ontology, *Universals: an Opinionated Introduction*, and *A World of States of Affairs*, David Armstrong gives a new argument against nominalism. That argument seems, on the face of it, to be similar to another argument that he used much earlier against Rylean behaviourism: the Truthmaker Argument, stemming from a certain plausible premise, the Truthmaker Principle. Other authors have traced the history of the truthmaker principle, its appearance in the work of Aristotle (FOX 1987), Bradley (OLSON 1987), and even Husserl (MULLIGAN, SIMONS, AND SMITH 1984). But that is not my task — in this paper I argue that Armstrong's new argument is not logically analogous to the old, and, in particular, that it is quite possible to be a thoroughgoing nominalist, and hold a truthmaker principle.[1]

For the purposes of this paper, by nominalism I shall mean a position rather stronger than what is usually meant by that word. I shall mean the belief that the world is composed entirely of *things*, of spatio-temporally located, concrete, causally efficacious particulars. No universals, numbers, classes,

tropes, or abstracta are to be found in this ontology. When I wish to distinguish this nominalism from weaker ones — that allow, for example, tropes, or extensional classes — I shall call my version 'thoroughgoing nominalism'. This position may not be a happy one for independent reasons. Indeed, Armstrong's earlier argument against nominalism, the 'One over Many' argument (ARMSTRONG 1978A; ARMSTRONG 1980A) claims to be just such a reason. My aim here is not to defend thoroughgoing nominalism against all such objections but merely to show that it is compatible with a truthmaker principle. And if even thoroughgoing nominalism is not touched by a truthmaker argument, then weaker versions, that claim less, will not be touched either.

As part of showing this, I distinguish the truthmaker principle from an additional thesis, 'truthmaker essentialism'. Though this additional thesis is usually held with the truthmaker principle, it is not required in — what I take to be the canonical use of the truthmaker argument — the argument against Rylean behaviourism. It's a distinctive feature of my truthmaker theory that I hold that this essentialist thesis is false; however, I will not be arguing for that here. All I will need is that it is distinct from the truthmaker principle proper.

A.1.1   Truthmakers Against Behaviourism

To turn now to the truthmaker argument, we must run the clock back to 1968, when Armstrong first published his *Materialist Theory of the Mind*. Therein we encounter Gilbert Ryle's view that 'To possess a dispositional property *is not to be in a particular state, or to undergo a particular change*; it is to be bound or liable to be in a particular state or to undergo a particular change, when a particular condition is realised' (ARMSTRONG 1968, p. 85) (The italics are Armstrong's, not Ryle's). Armstrong compares this view to his own that 'to speak of an object's having a dispositional property entails that it is in some non-dispositional state or that it has some property ... which is responsible for the object manifesting certain behaviour [i.e. the disposition]'.

Under the influence of C.B. Martin, Armstrong had come to believe that the trouble with Ryle's dispositions was that they required that there be truths without truthmakers. It may be true that someone has a belief which is never manifested in their behavioural dispositions: the belief that worms are not typically bearded, for example. Armstrong agreed with Ryle's dispositional

view about belief, though; it's just that he insisted that there must be some difference in the world, some difference that the disposition makes, which *makes it true* that, at times when the disposition is not being manifested, it *would* be manifested, were we to ask, say, 'Do worms have beards?'

In today's language, we might state this as that dispositional properties supervene on purely qualitative ones.[2] This suggests an account of truthmaking in general: to say that a certain class of sentences (in our case, sentences asserting dispositions) are made true is to say that those sentences supervene for their truth on the qualitative properties of something in the world. 'Qualitative' is here used by contrast with 'dispositional', but it is equally intended to cover something of what is meant by 'intrinsic'. There is of course, much debate to be had over the exact meaning of all these terms, but that is not my project here. Suffice it to say that I shall use 'intrinsic' and 'qualitative' specifically to exclude barely dispositional and relational properties, as well as all such gerrymandered 'impure'[3] properties as 'being such that Socrates was wise' (at least where that property is not had by Socrates himself).

Since nominalism is in the background here, it would be better to prefer a more neutral formulation for our principle: let us say that, for every true sentence, there is something on whose *nature* that sentence's truth supervenes, and that thing is the sentence's truthmaker. One might gloss a thing's nature as a grand conjunctive property, conjoining all of the thing's intrinsic properties.[4] To say the least, this gloss is not *obviously* compatible with nominalism, but it gives you the idea. I must emphasise, though, that it is no part of the conception of a nature that a thing couldn't have failed to have the nature it actually does. This assertion, that every true sentence's truth supervenes on the nature of some thing, is what I will mean by the 'truthmaker principle'.[5]

To put this another way, for every true sentence, there is some thing such that the sentence cannot become false without a qualitative change, a non-Cambridge change, in that thing. That thing, whatever it is, is the sentence's truthmaker. Or, the truthmaker for a sentence is that thing that is intrinsically such that the sentence is true. I am such that Socrates was wise, let us say. But, I am that way *extrinsically*. A duplicate of me could exist in a world where Socrates was foolish. If this wasn't so, and I (or my duplicates) somehow excluded Socrates from being foolish, I could count as a truthmaker for 'Socrates was wise'.

The Rylean theory of dispositions is in conflict with this principle, because, on the Rylean view, a true sentence expressing a disposition entails nothing

about the intrinsic nature of the world. If my beliefs were Rylean dispositions, I could cease believing something without any real change taking place in me or indeed anywhere in the world. All that is required is that I cease to be 'liable to be in a particular state ... when a particular condition is realised'. If that condition was not realised when I ceased believing, no change need occur at all. But yet, at some point it would cease to be true that I believed. This is precisely the sort of thing that the truthmaker principle denies. There is thus a truthmaker argument against Ryle, having the truthmaker principle as its premise.

For the purposes of this paper, I will grant that Armstrong's truthmaker argument against Ryle (as I have here interpreted it) is sound. However, as I will argue, it is not logically analogous to his argument against nominalism, so there is no reason for admirers of the former to believe the latter.

A.1.2   Truthmakers Against Nominalism

And so we come to Armstrong's new argument:

> Accepting the truthmaker principle will lead one to reject Quine's view that *predicates* do not have to be taken seriously in considering the ontological implications of the statements one takes to be true. Consider the difference between asserting that a certain surface is red and asserting that it is green. An upholder of the truthmaker principle will think that there has to be an ontological ground, a difference in the world, to account for the difference between the predicate "red" applying to the surface and the predicate "green" so applying.   (ARMSTRONG 1989, p. 89)

The point of invokving Quine here is that, according to Quine's criterion of ontological commitment (QUINE 1953), to say 'There is a red surface' commits us to no *more* things than 'There is a surface' commits us to. To be is to be the value of a bound variable in first order logic, and variables ranging over red surfaces range over no more (indeed, less) than those that range over all surfaces do.

If Quine's criterion is right, nominalism is fairly easy. All a theory has to do to be nominalistically respectable is to refrain from quantifying over any of the disreputable kinds of entity that I enumerated in section I. By contrast,

if Armstrong is right that predicates are ontologically committing, in a way incompatible with Quine's principle, it seems difficult for a nominalist to say what they are committing us to. The truthmaker principle asserts that true sentences have truthmakers. So, Armstrong wishes to add to Quine's criterion, that besides being committed to the domain of quantification of our assertions, we are committed to their truthmakers.

But is the truthmaker principle really incompatible with Quine's criterion? Quine is not saying, nor need a nominalist be saying, that 'there are red roses' is not ontologically committing at all. Nor, that the truth of this sentence makes no difference to the world. What is there, then, to stop us identifying an item in the domain of quantification of a sentence, which we are already committed to by Quine's principle, and calling it the truthmaker of that sentence?

It is of the nature of a red rose that it is red, let us suppose. And suppose that I have a red rose. If I say 'This rose is red', for that sentence to become false, there must be a change in the rose. And that would be no mere Cambridge change, not the sort of 'change' that the Great Pyramid undergoes at the moment a sandcastle falls on the English coast. It sounds as if the relationship between sentence and rose is of the right sort, by the letter of our definition of truthmaking, for the rose to count as a truthmaker for 'This rose is red.' So it would seem that one can be both a Quinean about ontological committment, and endorse the truthmaker principle.

A.2   Truthmaker Essentialism

I think that Armstrong would be prepared to grant all that I have said so far. He seems to be considering something like this proposal when he writes: 'Quineans, although they maintain the ontological insignificance of the predicate, do have a truthmaker for truths that ascribe properties to a particular. The truthmaker is the particular itself' (ARMSTRONG 1997, p. 125). So what has happened to the argument against Quine, and, indirectly, against nominalism?

Armstrong admits that his argument is not *apodeictic*: 'There is no high road from the principle to universals' (ARMSTRONG 1989, p. 89). Rather, the principle makes nominalism, on balance, rather less plausible than it would otherwise be. He believes that 'the truthmaking relation is an internal one ... [where] an internal relation is one where the existence of the terms

entails the existence of the relation ... in every world in which the terms exist, the relation holds between them' (ARMSTRONG 1997, p. 115). The internal relations, on this account, are *de re* necessary, and analogous to essential properties. I call the doctrine that truthmaking is internal in this sense 'truthmaker essentialism'.

I am taking truthmaker essentialism to be saying something additional to the truthmaker principle. According to the truthmaker principle, every truth has a truthmaker, in virtue of which that truth is true. According to truthmaker essentialism, every truth has a truthmaker, *which is essentially that truth's truthmaker*. This doctrine is quite maintstream in the truthmaker literature; so much so that those authors who hold it quite often incorporate it into their characterisations of the truthmaker principle itself.[6] Armstrong does not — he has a seperate argument to show that truthmaker essentialism is true (which we shall be meeting in the next section). Furthermore, as I have shown earlier, it is possible to run an Armstrong-Martin style argument against behaviourism without bringing in the essentiality of truthmaking. This seems to justify distinguishing the two notions.

But notice that truthmaker essentialism will cause trouble to a nominalist who goes the way I suggested in the previous section. For, not only are roses red, but they appear to be contingently red. If a red rose were to make true 'This rose is red', by truthmaker essentialism, that very rose could not fail to make the sentence true. That is, it could not fail to be red. Of course, if the rose could be somehow *distinguished* from what makes it true that it is red, this would not follow, but that road is not open to the nominalist.[7]

Now, before I go on to reflect on this new turn that the argument has taken, let us note that it no longer looks so analogous to the case against Ryle. To argue against Ryle, no mention of essential properties or 'internal' relations was necessary. Whereas, in the case of nominalism, the thesis of truthmaker essentialism emerges as a crucial premise. You might think that this thesis is true, and indeed that the argument is sound, and still agree with me that it does not count as a truthmaker argument, because it does not have quite the same form as the classic argument against behaviourism.[8]

What's one extra premise, though? In the remainder of this paper I argue that not only is the truthmaker principle insufficient by itself to prove Armstrong's case, but, given what appear to be his reasons for holding truthmaker essentialism, it is unnecessary.

A.2.1 Truthmakers Without Essentialism

Let's the nominalistic picture clear: a red rose, let us say, makes true the sentence 'This rose is red'. But that sentence is only a contingent truth (let us grant). In another possible world, that very rose (or its counterpart) exists, and is yellow. In that world, the rose does not make true 'This rose is red', and instead makes true 'This rose is yellow'.

To drop the metaphor of possible worlds, let us consider a case where contingency is replaced with change: a certain beacon takes the form of a light that alternates between glowing red and glowing green. When it is red, it makes true the sentence 'The beacon is red', but when it becomes green, it stops making this sentence true, and starts making 'The beacon is green' true.

Both of these cases are incompatible with truthmaker essentialism. According to truthmaker essentialism, making true is not the sort of thing you can stop or start doing, either over time or between possible worlds. Is there a case for truthmaker essentialism strong enough to convince us of the falsity of nominalism?

Armstrong gives a very brief argument: truthmaker essentialism

> seems evident enough if we consider for a moment the idea that the [truthmaker] relation should be external, contingent. If it is said that the truthmaker for a truth could have failed to make the truth true, then we will surely think that the alleged truthmaker was insufficient in itself, and requires to be supplemented in some way. A contingently sufficient truthmaker will be true only *in circumstances that obtain in this world*. But then these circumstances, whatever they are must be added to give the full truthmaker
> (ARMSTRONG 1997, p. 116)

What should we say about cases where a proposed truthmaker is seen to be insufficient? Suppose I claimed that only the rose's smallest petal, not the whole rose, makes it true that 'This rose is red'. This we can all agree to be an insufficient truthmaker. We do not need to advert to essentialism to refute this proposal, we merely need to apply the supervenience characterisation of truthmaking that I suggested in section II. One way that 'This rose is red' could become false, or fail to be true, would be if the rose were a rose of mixed colours, with some petals red and others yellow. So, this sentence

could become false even though the rose's smallest petal remained red; even
if there were no real change in the smallest petal at all. There would be
a change in the truth of the sentence without a change in the proposed
truthmaker. This shows that, back in the actual world, where the whole rose
is red, just the petal can't be the truthmaker.

Regardless of essentialism, it just isn't the case that the smallest petal makes
true 'The rose is red'. There is a way to mark the difference between proposed
truthmakers that are insufficient, and the real truthmaker of a sentence,
other than the distinction between essential and contingent truthmaking.
Insufficient 'truthmakers' are simply not truthmakers at all, they are proper
parts of truthmakers.[9]

But the case put forward by the nominalist is quite different. On the nomi-
nalist view, the whole red rose is not insufficient. Sure, it is only a truthmaker
in virtue of actually being red, but to a nominalist, the request that we 'add
this circumstance' to the truthmaker makes no sense. We have already added
it, in whatever meaningful sense it can be added, by adding the rose. And if
Armstrong means to say, 'there must be some further thing, besides the rose,
that we need to add', he begs the question. Nor is our nominalist simply
playing a linguistic trick, and calling an insufficient truthmaker a sufficien-
t one. Nominalists and realists can agree on what a paradigm insufficient
truthmaker would be (the smallest petal case), and on why it is insufficient.

A.2.2   'Intrinsic' and 'Essential'

Another way of reading Armstrong's argument for truthmaker essentialism
is to concentrate on the word 'external' and ignore the word 'contingent'.
Perhaps his criticism is really directed towards the view that 'x makes true
y' is more like 'x is one meter away from y' than like 'x is one meter taller
than y'. In the taller than case, once you know the heights of x and y,
you know who is taller. But there's nothing you could know just about the
intrinsic nature of x or the intrinsic nature of y that will tell you how far
apart they are. That depends on something beyond just x and y themselves.
Here we have a distinction between external and internal relations in a sense
different to the one that Armstrong is officially using.

This new sense of internal vs external relations emphasises intrinsicality
rather than essentiality. Where, for Armstrong, if the relata of an inter-
nal relation exist, then the relation holds between them (like an essential

property), for this new conception of internal relation, duplicates of the relata would do just as well (like an intrinsic property). This new sense is not in any way idiosyncratic. It is the sense in which such a careful metaphysician as David Lewis uses the terms (LEWIS 1986, p. 62).[10] It is the sense in which Bertrand Russell used the terms in his classic attack on the British idealists' axiom of internal relations (RUSSELL 1910, pp.160–161).[11]

Now it would be very peculiar indeed if the truthmaking relation turned out to be external in this sense. If a duplicate of the red rose could fail to make true 'This rose is red', then we would indeed be tempted to say that the red rose was insufficient as it stood, no true truthmaker. But this does not, on the face of it, make any essentialist point. It says nothing more than what the truthmaker principle does. According to the truthmaker principle, as I've stated it, the truth of a sentence supervenes on the qualitative nature of its truthmaker. That nature is precisely what duplicates duplicate, so a duplicate of a truthmaker will do as well for truthmaking purposes as the original.

Armstrong seems to take this as unquestionable evidence that the relation must be internal in his sense too. In fact he quite generally seems to hold that all intrinsic properties of a thing are essential to their instances: '[I]f a particular is taken along with all its non-relational properties, then it will have all these properties "in every possible world". So, in a sense, it has every such property necessarily' (ARMSTRONG 1997, p. 125). The alternative to taking a particular 'along with' its properties is taking it to be propertyless: '[I]n one sense a particular is propertyless. That is the thin particular. In another sense it enfolds properties within itself. In the latter case it is the thick particular' (ARMSTRONG 1989, p. 95). For Armstrong, there seems to be no middle road between taking a particular to have a property essentially, and taking it to have that property, at best, by proxy, by being related to the thick particular that has the property essentially.

If this 'Leibnizian essentialism' were right, then the 'intrinsicalist' account of internal relations would indeed collapse into the 'essentialist' account in the way that Armstrong expects. This is, for example, how he is able to treat resemblance as an internal relation in his sense: '[T]o fall under our definition of internal relations, the particulars involved must be taken as having their non-relational properties' (ARMSTRONG 1997, p. 88). Of course, they must be taken not only as having those properties, but as having them essentially: recall, an internal relation for Armstrong is one that is entailed by the mere existence of its relata. To Armstrong, though, this is all one: there is not distinction to be made between having a property and having it essentially,

nor between essential and accidental properties (ARMSTRONG 1997, p. 124).

Armstrong can consistently take the same view about the truthmaker relations as he does about resemblance: it is internal in the Lewis/Russell sense, and therefore in his own sense, as the distinction between the two rests on a (by his lights) mistaken distinction between accidental and essential properties. This would justify his use of truthmaker essentialism. But only on the Leibnizian assumption that to have a property is to have it essentially.[12]

A.2.3   Essentialism Without Truthmakers

Leibnizian essentialism is not an entirely unpopular doctrine. It has an important argument in its favour — the argument from the indescernability of identicals. Surely, in some sense, I cannot fail to be the same height as myself. According to the argument, it follows from this that I could not have been any taller or shorter while retaining my identity. And so on for any real, qualitative change.

Someone who holds, as Armstrong does, that there are *sui generis* truthmakers, states of affairs, can sweeten this bitter pill a little. Look, he can say, you could be taller alright, but only because we are treating you as a thin particular. That thing continues to exist, and it is a thing which could be taller, in that it is a constituent of a state of affairs of its being a certain height at one world, and constituent of another state of affairs of its being another height at a different world.

For my present purposes, it does not matter whether Leibnizian essentialism is true or false — for it appears to be an issue wholly independent of the truthmaker principle. If the argument against nominalism depends on truthmaker essentialism, which in turn depends on Leibnizian essentialism, it is sounding less and less like the paradigm truthmaker argument against Ryle, and more and more like some new argument, which, if sound, is not a truthmaker argument. In fact, now that we have arrived as the Leibnizian roots of the argument against nominalism, we can drop the truthmaker principle as a premise.

Consider the following triad of propositions:

1. There is contingency in the world: a certain rose might not have been red, but yellow, I might have been taller than I am, and so on.

2. Leibnizian essentialism: all intrinsic properties are essential ones.

3. Thoroughgoing nominalism: there are only concrete things.

Armstrong can resolve the seeming antinomy between 1 and 2. The strategy would be to explain away *de re* contingency — contingency in the nature of things, 'in the properties that things have' — in terms of internal relations to contingently existing states of affairs. The rose (*qua* thin particular) is not contingently red (it's not really red at all), but it is contingent that there is a state of affairs of its being red. This state of affairs might have failed to exist (but could not fail to be red). We must not let the contingent truth of 'The rose is red', based on the contingent existence of its truthmaker, lead us to hold that there is anything which is, *de re*, contingently red. There is not really any *de re* contingency here, though we can explain away the illusion of it.

But this is at the cost of proposition 3. It requires that besides all the things, all the roses, people, and so on, there be thin particulars: propertyless abstracta which the thoroughgoing nominalist cannot countenance. 1 and 2 may thus be taken together as an argument against 3. This argument would appear to be valid; if Leibnizian essentialism, and the (Moorean?) fact of contingency are true, it is sound. But not a whiff of truthmaking has entered. This, I contend, is the real argument suggested by the principle of truthmaker essentialism, and it is completely independent of the truthmaker principle.

A.3   Conclusion

So, contrary to popular belief, David Armstrong has given no valid truthmaker argument against nominalism. He may have given a valid argument of some kind, but, if he has, it has the truthmaker principle among its premises only on an honorary basis. Not only is the truthmaker principle insufficient to refute nominalism, but, placed in a strong enough context to form a valid argument against nominalism, it is unnecessary.

As a subsidiary point, a fairly radical brand of nominalist can hold a truthmaker principle. This sort of nominalist will of course hold that all truthmakers are ordinary concrete things like chairs and tables, what I call the 'facts in a world of things' view.[13] She will inherit the old problems of negative and general facts,[14] that face all truthmaker theorists. She will also have to deal with some of the problems that face less radical nominalists,

for example, the account to be given of relational facts, which troubles some trope theorists.[15] Additionally, any nominalist needs to give an answer to the many other arguments against nominalism ably surveyed by Armstrong (ARMSTRONG 1978A).

Here I will make no comment on the practicality of surmounting these obstacles. But at least I hope I have shown there to be one fewer of them than there might be.[16]

Notes

[1]It may be that Armstrong does not himself think that the two arguments (the one against Ryle and the one against nominalism) are two arguments of the same form. He does not dispel the illusion, though, writing of 'the truthmaker argument . . . as a certain *style* of argument'. (ARMSTRONG 1997, p. 115)

[2]One might add to the supervenience basis, in the case of dispositions, the relevant laws of nature. However, it is presumably the qualitative nature of the laws in turn that is required — the law of gravity would not underwrite the disposition of dropped objects to fall at about 10 m/s, were the gravitational constant to have a different value — and so my original formulation stands.

[3]For a discussion of impure properties and their relationship to intrinsic ones, see (HUMBERSTONE 1996), esp. section 2, pp. 209–227

[4]As in Armstrong: (ARMSTRONG 1997, p. 125).

[5]An account of truthmaking in terms of supervenience is hardly novel. Armstrong emphasises the connection between the two: (ARMSTRONG 1997, pp. 11–14), and in connection with dispositions (ARMSTRONG 1997, p. 82). In their recent philosophy of mind text, David Braddon-Mitchell and Frank Jackson treat truthmaker issues of the kind raised against Ryle as expressions of supervenience theses (BRADDON-MITCHELL AND JACKSON 1996, pp. 15–17).

[6]Often this is done by a locution such as Bigelow's 'Whenever something is true, there must be something whose existence entails that it is true' (BIGELOW 1995, p. 125). What makes this essentialist is that it is the mere existence of what is actually the truthmaker that is said to be sufficient for the sentence's being true.

[7]Interestingly, Armstrong comes close to falling into the same trap, holding as he does that thick particulars (among them all the roses) are the states of affairs of that particular having whatever nature it has (ARMSTRONG 1997, p. 125). For more on this, see below, sections VI and VII.

[8]The prevalence of truthmaker essentialism might lead some people to say that the truthmaker principle is what I'm calling the principle, *plus* truthmaker essentialism. This is not an objection to what I'm saying here. The argument against Ryle needs only the

principle *minus* truthmaker essentialism. Regardless of which principle really deserves the name 'truthmaker principle', this is still a point of disanalogy between the two arguments.

[9]Some truthmakers for a sentence p might have proper parts that are also truthmakers for p. In this case, the insufficient 'truthmakers' for p are all the parts of the *minimal* truthmaker for p; the truthmaker that has no proper parts as truthmakers. (For more on minimal truthmakers, see (MULLIGAN, SIMONS, AND SMITH 1984, p. 297–298). Though Mulligan, Simons and Smith are often cited as the origin of the notion of 'minimal truthmaker', it was probably first used by Bruce Langtry (LANGTRY 1975, p. 9)).

[10]See also his discussion of similarity as the paradigm internal relation (LEWIS 1986, pp. 176–179); and, on the relationship between intrinsic properties and internal relations, (LANGTON AND LEWIS 1998, Section VIII)

[11]Note particularly Russell's characterisation of external relations: '[T]here are such facts as that one object has a certain relation to another, and such facts cannot in general be reduced to, or inferred from, a fact about the one object only together with a fact about the other object only: they do not imply that the two objects have ... any *intrinsic* property distinguishing them from two objects which do not have the relation in question'.

[12]Armstrong has suggested to me (in conversation) that I am taking insufficient notice of the fact that he espouses a counterpart theory, so that for him, what it would be for (e.g.) a rose to be essentially red, would be for there to be nothing in another possible world that was both red and shared a certain kind of constituent (a thin particular) with the rose. But what then does he mean by 'the truthmaking relation is internal'? If he means the strong claim that no counterpart of a truthmaker for p could ever fail to make p true, then he is still committed to Leibnizian essentialism, for among those truthmakers are the thick particulars. If he means the weak claim that no truthmaker for p could ever fail to make p true (but its counterparts might) then the doctrine he holds is not truthmaker essentialism, but something quite compatible with thoroughgoing nominalism.

[13]It's an interesting question whether what I have said here on behalf of nominalism could be said, on behalf of realism, as a defence against John Fox's truthmaker argument against realism ((FOX 1987), see also (BIGELOW 1995, pp. 135–138)). Fox argues that a believer *only* in universals and substances (and not in, say, states of affairs, or tropes) cannot construct truthmakers for sentences asserting that a particular has a property accidentally. Fox's argument shows at least, that for a nominalist contemplating truthmaker essentialism, merely adding universals to her ontology will not help. If, *contra* Fox, truthmaker essentialism is to be denied, a believer in just universals and particulars could believe in the nominalistic view I have advertised; but that leaves a question mark over what reason such a person has for believing in universals, if particulars are enough to account for all their truthmakers. For this reason I think Fox's argument meets its mark regardless of the status of truthmaker essentialism. (Fox's argument doesn't claim to be analogous to the Armstrong-Martin argument against Ryle).

[14]For a broadly nominalist attempt to deal with these, see (SIMONS 1992).

[15]See, for example, (CAMPBELL 1990, Chapter 5).

[16]Thanks to David Armstrong, Helen Beebee, Richard Holton, Rae Langton, Cathy Legg, Daniel Nolan, and Daniel Stoljar for comments and discussion on this paper.

Appendix B

Truthmakers continued

Unpublished paper entitled "What is the problem of Truthmakers?"
(PARSONS 2001B)

B.1   Introduction

Truthmaker Theory has two parts. As Kevin Mulligan, Peter Simons, and
Barry Smith put it in their classic paper "Truth-Makers":

> The neutral term "truth-maker" enables us to seperate the gener-
> al question of the need for truth-makers from the more particular
> question as to what sort — or sorts — of entities truth-makers are.
> (MULLIGAN, SIMONS, AND SMITH 1984, p. 280)

Questions of the first kind make up the formal theory of truthmakers, con-
cerning why we should believe in truthmakers; what it is to make a sentence
true; what the relationship between the truthmaker of a conjunctive (or dis-
junctive) sentence and the truthmakers of its conjuncts (or disjuncts) might
be — things that can be characterised solely in terms of truthmaking. The
formal theory of truthmakers usually asserts the Truthmaker Principle, that
all truths require truthmakers (with, perhaps some exceptions according to
taste for general or negative truths).

The second, material theory of truthmakers, concerns what kinds of things
realise the truthmaker role. While truthmaker theorists, insofar as they are

talking about a common subject matter, tend to converge on the formal theory, there are (nearly) as many material theories of truthmaking as there are truthmaker theorists. Truthmakers could be identified with tropes (MULLIGAN, SIMONS, AND SMITH 1984), or with 'states of affairs' (ARMSTRONG 1997), or with concrete particulars (PARSONS 1999).

My concern in this paper is with attempts to argue from the formal part of truthmaker theory to the material part. That is, to establish a certain ontological view — the falsity of nominalism — on the basis of the formal theory of truthmaking alone.

I think that that kind of project is a mistake. The force of a Truthmaker Principle should be to prevent metaphysicians from shirking their ontological responsibilities. A plausible sounding theory can require a very implausible ontology. Perhaps this can be best shown with a quick example: Rylean behaviorism.

The Rylean holds that mental states are "bare dispositions" — they don't have any consequences for the actual qualitative nature of the world. A world in which I believe that worms have no beards could be qualitatively just like a world in which I don't believe that worms have no beards (provided in each world, the disposition corresponding to each belief is not manifested). It follows that the Rylean has no distinctive ontological commitments — she is committed neither to dualism or materialism.

But this will not do: the Rylean lacks truthmakers for belief statements — there is no "difference in the world" corresponding to differences in belief (according to Ryle). Truths require truthmakers, says the Truthmaker Principle, and there's no way to provide truthmakers for belief statements, without providing an ontology of the mental. There's nothing to stop Ryle, of course, accepting the Truthmaker Principle, and believing in a kind of Platonic realm of dispositional truthmakers which are neither physical nor of the sort of stuff that dualists believe in — and so remaining neutral between physicalism and dualism in the way that behaviourism was supposed to. If he did that, however, the Truthmaker Principle would have done its work: a Platonic behaviourist is not shirking any ontological commitments (though that view may have other problems). It's a mistake to try to go after a Platonic behaviourist with arguments from the formal theory of truthmaking.

Similarly for any kind of nominalism, or anti-nominalism for that matter. These are already explicitly ontological doctrines, and there should be no objection to them on the basis of merely the *formal* theory of truthmakers.

Nevertheless, it has been claimed at various times by David Armstrong (ARMSTRONG 1989; ARMSTRONG 1997), and more recently by Gonzalo Rodriguez-Pereyra (RODRIGUEZ-PEREYRA 2000), that a certain kind of nominalism, which I will call "thoroughgoing nominalism", can be refuted by appeal to the Truthmaker Principle. Rodriguez-Pereyra presents the relevant arguments particularly clearly and explicitly, so it is he who will be my principal stalking-horse.

B.2   Background

Thoroughgoing nominalism is the doctrine that there are only concrete particulars. There are no universals, tropes, or classes, only *things*: such familiar objects as chairs, tables, human bodies, and electrons. Roughly, a *thing* is something that one can, in principle, kick. I can certainly kick a chair; if I were small enough, I could kick an electron; if I were big enough, and robust enough, I could kick a star — but I don't have any conception of what it would be to kick triangularity, or the empty set.

There are many ways to challenge thoroughgoing nominalism. One is to appeal to the role of mathematics in our best science. Another is to point to the difficulty of analysing away 'abstract reference', as occurs in sentences like "The colour blue is more similar to green than to red".

In this paper, I won't be interested in these questions, because I'm not interested here in the truth or falsity of thoroughgoing nominalism, but rather of what I will call "Truthmaker Nominalism" — the doctrine that the *things* exhaust all the truthmakers. It might be that to fully accomodate science or semantics, we may need abstracta. Truthmaker Nominalism is the relatively restrained view which, accepting this possibility, holds that abstracta are not needed merely for an account of truthmakers. Rather, the truthmakers are all to be identified with concrete particulars. Truthmaker Nominalism is thus a material theory of truthmakers. Truthmaker Nominalism does not entail thoroughgoing nominalism, but it does entail that thoroughgoing nominalism cannot be refuted by appeal to Truthmaker Theory.

Suppose I have a red rose, called, for convenient reference, "Rosie". The Truthmaker Nominalist holds that "Rosie is red" is made true by Rosie. Why Rosie, and not anything else? Because, were this sentence false, it is Rosie that would be different, and not anything else.[1] Rosie is, as Armstrong would

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[1] I assume a naïve theory of colour here — readers unhappy with this are welcome to

put it (ARMSTRONG 1989, p. 89) the "difference in the world" between our world, were "Rosie is red" is true, and other worlds, where "Rosie is red" is false.

Rodriguez-Pereyra doesn't believe, however, that this sort of account can work — even going so far as to identify this problem with the traditional "problem of universals" which was supposed to confront nominalism. In the remainder of this paper, I consider his arguments.

B.3   The Argument from Contingency

Rodriguez-Pereyra offers two arguments against Truthmaker Nominalism. The first concerns the contingency of the connection between truths and truthmakers according to the Nominalist approach:

> One might think that the truthmaker version of ostrich nominalism fails simply because a sentence like "a is F" may be *contingently* true. If so, then a does not suffice to make it true that it is F, since "a exists" does not entail "a is F", for the former may be true and the latter false. Therefore a is not the truthmaker of "a is F". (RODRIGUEZ-PEREYRA 2000, p. 268)

Many truthmaker theorists connect truthmaking with entailment. Some loosely say that a truthmaker for a given sentence entails that that sentence is true. But this is a confusing usage. Only truthbearers (be they sentences, or whatever) can entail each other; and many truthmakers, on anyone's account, are not truthbearers. What truthmaker theorists really mean when they say this sort of thing is that a sentence asserting that a truthmaker for p exists entails p. Thus, Rodriguez-Pereyra endorses a principle he calls T*: (RODRIGUEZ-PEREYRA 2000, p. 262)

  T∗ If E is a truthmaker of S then "E exists" entails S.

The force of T* is that a truthmaker's truthmaking activities are *essential* to it. Reading "entails" in the familiar possible worlds way, if E is a truthmaker

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substitute some predicate of fundamental physical science if they wish.

of S then E doesn't just make S true around here — it makes S true in every possible world at which it exists — which is to say that E essentially makes S true.

Given that Rosie, presumably, exists at lots of worlds where Rosie is not red, Rosie doesn't look like a plausible candidate for something that *essentially* makes "Rosie is red" true. This is, I think, a good and difficult problem for thoroughgoing nominalism. But it is not any problem specifically to do with truthmakers — it is a problem to to with essential properties.

Compare the relationship between me and my body. My body, many people would like to think, is the sort of thing that could not fail to be a human being — it is *essentially* a human being. I, on the other hand, could perhaps have been a disembodied spirit; or have had a robot body; or a Martian body. This makes it hard to believe that I am identical to my body.

Another example: suppose I make a statue of Rosie out of plastic. The particular lump of plastic I used, we would perhaps like to think, could not have been some material other than plastic, could not have been partially clay, for example. It is *essentially* wholly plastic. However, I could have made that very statue out of clay, or out of a mixture of clay and plastic. The statue does not appear to essentially wholly plastic. This makes it hard to believe that the statue is identical to the material that it is composed of.

Each of these examples is a *prima facie* argument against thoroughgoing nominalism. If we want to hang onto our judgements about the essential properties, we'll need to give up thoroughgoing nominalism. Conversely, if we want to hang onto thoroughgoing nominalism, we'll need to be more careful in trusting our intuitions about essential properties than we might be. We may need to give up on the idea that my body is essentially a human body, or that lumps of plastic essentially contain no clay, or, that whatever makes it true that "Rosie is red" does so essentially.

This is not to say that a thoroughgoing nominalist rejects any connection between truthmaking and entailment. T* can be purged of its essentialism, to produce a principle like this:

T ∗∗ "E is a truthmaker of S" entails S.

T** represents a weaker connection between entailment and truthmaking than T*. In particular, T** cannot play the role played by T* in the argument from contingency, because it does follow from "Rosie is a truthmaker of 'Rosie is red'" that "Rosie is red".

B.4 The Argument from Multiplicity

Rodriguez-Pereyra does not take the argument from contingency to be conclusive. He follows it up with another argument that he does take to be conclusive, though:

> [C]an "Socrates is human" and "Socrates is moral", predicating such different characteristics of Socrates, both have the same truthmaker? Can those two sentences be true in virtue of the same thing when "is human" and "is moral" are not even coextensive predicates? (RODRIGUEZ-PEREYRA 2000, p. 268)

The principle implicit in this paragraph, that sentences having just the same truthmakers should have just the same truth conditions, is plausible. Let us call it the relevance principle — a sentence's truthmaker must be relevant to that sentence. It is not trivial to formulate it accurately.

We might be tempted to say that, if two sentences have the same truthmaker, then they have the same truth conditions — they are logically equivalent. Talk of "the same truthmaker", however, glosses over the fact that sentences may have many truthmakers. In addition, disjunctive sentences may share truthmakers with their disjuncts:

> Disjunctions show that the truthmaking relation is not one-one, but many-many. On the one hand, some truthmakers make true more than one sentence: the fact that Socrates is white makes true both "Socrates is white or Socrates is round" and "Socrates is white or Plato is white". On the other hand, some sentences, like "Socrates is white or Plato is white", have more than one truthmaker: the fact that Socrates is white and also the fact that Plato is white, the existence of either of which entails the truth of the sentence. (RODRIGUEZ-PEREYRA 2000, pp. 262–263)

To accomodate these points, we could make the relevance principle say that if two true sentences have *all and only* the same truthmakers, then they are logically equivalent. That is,

$$\mathbf{R} \quad \Big(p \wedge q \wedge (\forall x)(x \text{ makes true } p \equiv x \text{ makes true } q) \Big) \supset \Box \Big(p \equiv q \Big)$$

R does rule out Truthmaker Nominalism in the way that Rodriguez-Pereyra suggests. If Truthmaker Nominalism is true, that Rosie would be the only truthmaker for both 1 and 2, below:

  1 "Rosie is red."

  2 "Rosie is rose-shaped."

These two sentences are far from being logically equivalent — so R clearly furnishes a valid argument against Nominalism.

Forunately for Truthmaker Nominalists, however, R is false on independent grounds. The counter-example is a pair of sentences which Rodriguez-Pereyra himself uses as an example in a different context. (RODRIGUEZ-PEREYRA 2000, p. 262) Consider 3 and 4:

  3 "Socrates is white."

  4 "Socrates is white or Socrates is round."

Suppose that 3 has just one truthmaker (Socrates' whiteness trope, perhaps) and that Socrates is not, in fact, round. In that case, 3 and 4 will have all and only the same truthmakers, while not, of course, being logically equivalent. This is a counterexample to R as it stands.

A distinctive point about this class of counterexample is the contingency of the coincidence between the truthmakers of 3 and 4. It might have been the case, perhaps, that Socrates was round. In that case, 4 would have had an additional truthmaker, namely, whatever it is would have made true "Socrates is round", and it would be no counterexample to R. This suggests a weakening of R to avoid the counterexample: what the relevance principle should say is that if two sentences have, necessarily, all and only the same truthmakers (if, that is, they coincide in their truthmakers, in each possible world, not just in the actual one), then they are logically equivalent. Thus:

  R∗ $\Box(\forall x)(x$ makes true $p \equiv x$ makes true $q) \supset \Box(p \equiv q)$

R* is not refuted by the example of 3 and 4, because there's a world at which Socrates is white and round, and in that world, 4 does not have all and only the same truthmakers as 3.

Fortunately again for Truthmaker Nominalists, R* does not rule out Truth-maker Nominalism in the way that R does. 1 and 2 have the same truthmaker in the actual world, but not in any world in which Rosie is not red. In those worlds, 1 is false and has no truthmakers, while 2 is true and has Rosie as a truthmaker.

Notice that this is dependent on the Truthmaker Nominalist's rejection of Truthmaker Essentialism. It's because Rosie *might not* have made true those sentences she actually does that it is possible for worlds to vary in regard to whether 1 is made true, independently of whether 2 is made true, in spite of the fact that, wherever both are made true together, it is by the same thing, Rosie. If, as Truthmaker Essentialism would have it, Rosie could not exist without making true all those sentences she actually makes true, then Rosie could not exist without making 1 true. A fortiori, she could not make 2 true without making 1 true, and vice versa.

So, R* does offer some argument against Truthmaker Nominalism, by draw-ing attention again to the fact that a Truthmaker Nominalist should reject Truthmaker Essentialism. This argument, however, is dependent on the same premise, Truthmaker Essentialism, as the much more straightforward argu-ment considered in the previous section, the argument from contingency. Thus R* even makes sense of Rodriguez-Pereyra's argument, as a covert ap-peal to Truthmaker Essentialism (which, after all, he assumes a Truthmaker Nominalist will accept). But perhaps there is a stronger relevance principle that might rule out Truthmaker Nominalism while avoiding the counterex-ample to R?

What anti-nominalists perhaps find objectionable about 1 and 2 on the Truthmaker Nominalist view, is not that they're actually made true by just the same things, but that, wherever they're both true, they're *always* made true by the same things. This is not the case for 3 and 4. This suggests yet a third version of the relevance principle:

$$\mathbf{R} * * \ \Box\Big(\forall x\Big)\Big((p \wedge q) \supset (x \text{ makes true } p \equiv x \text{ makes true } q)\Big) \supset \Box\Big(p \equiv q\Big)$$

In spite of its initial appeal, R** is in exactly the same position as R. It licenses an argument against Truthmaker Nominalism in the same way that R does, but, like R, it has an independent counterexample, this time not one considered by Rodriguez-Pereyra:

  5 "Rosie is red or Rosie is yellow."

   6 "Rosie is red or Rosie is purple."

On anyone's account, not just the Truthmaker Nominalist's, 5 and 6 will come out to be made true just by whatever it is that makes true "Rosie is red" (perhaps Rosie's redness trope) in every world in which 5 and 6 are both true. This is incompatible with R**.

Finally, perhaps a desperate anti-nominalist might offer as a relevance principle R or R** restricted to non-disjunctive sentences.

While there is an obvious sense in which 4–6 are disjunctive (they contain the English word "or"), this is not required for them to act as counterexamples to R and R**. The disjunctive examples I have used can made into subject-predicate sentences by defining up 'disjunctive' predicates like, for example, "whound", applying to all the white things, and, in addition, all the round things. We can write 4 as:

   4′ "Socrates is whound."

For familiar reasons,[2] it is much, much, harder to say what makes a predicate like "whound" disjunctive (if, indeed there is any sense in which it is disjunctive) than it is to say what makes a sentence disjunctive.

The only plausible reading of the argument from multiplicity that I can find makes its premises R*, Truthmaker Essentialism, and, of course, the Truthmaker Principle. From these it follows that thoroughgoing nominalism is false; but the same follows from Truthmaker Essentialism and the Truthmaker Principle, without R* — as is shown by the argument from contingency. The argument from multiplicity, is, therefore, no advance on the argument from contingency as an attempt to refute thoroughgoing nominalism.

B.5   Conclusion

None of what I have said should be very surprising if we keep in mind the comments with which I began. The formal theory of truthmaking is a broad

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[2]I refer, of course, to the literature (STALKER 1994) surrounding Goodman's "new riddle of induction", and the predicate "grue". "Grue" is 'disjunctive' in the same sense that "whound" is — notoriously, it is very difficult to lay down an exact specification of what that sense is.

church; it describes just what we mean by talk of truthmakers without pre-judging the underlying metaphysics. It should be surprising if such a theory were to rule out thoroughgoing nominalism.

The division of Truthmaker Theory into two distinct parts is part of its attraction. There is little consensus on what the question is, to which general ontological theories like realism, thoroughgoing nominalism, or trope theory are the answers. Such a question should not presuppose any of the global ontological theories themselves.

Truthmaker Theory seems to offer such a question: what are the truthmakers? For it to be an advance in understanding general ontological theories, this question should be able to be made sense of in any such theory.

Appendix C

Four-dimensionalism and Temporal Parts

Because the notes to this appendix are quite lengthy, I have gathered them at the end of the appendix, rather than placing them at the foot of the page they belong to.

C.1   Introduction

The following quotation, from Frank Jackson, is the beginning of a typical exposition of the debate between those metaphysicians who believe in temporal parts, and those who do not:

> The dispute between three-dimensionalism and four-dimensionalism, or more precisely, that part of the dispute we will be concerned with, concerns what persistence, and correllatively, what change, comes to. Three-dimensionalism holds that an object exists at a time by being *wholly present* at that time, and, accordingly, that it persists if it is wholly present at more than one time. For short, it persists by *enduring*. Four-dimensionalism holds that an object exists at a time by having a *temporal part* at that time, and it persists if it has

> distinct temporal parts at more than one time. For short, it persists
> by *perduring*   (JACKSON 1998, p. 138)

In the light of these comments, some readers will perhaps find the question that forms the title of this paper a little puzzling. They may have learned to use the terms 'four-dimensionalism' 'perdurantism' and 'belief in temporal parts' interchangeably; or perhaps even to define one in terms of the other.

Such a usage, however, is inapposite. We might imagine a Flatland-like world of two spatial dimensions and one temporal, whose philosophers are divided between a theory of persistence on which they persist by having temporal parts, and a theory on which they persist by being wholly located in each of several times. This is just the same issue we face, but at least the label 'four-dimensionalism' seems inapposite: the four-dimensionalist Flatlanders believe in only three dimensions![1]

In any case, this is not the usage intended by Jackson. Temporal parts are a 'part of the dispute' between four- and three-dimensionalists, not the whole of that dispute. For Jackson, four-dimensionalism is a broader programme that (allegedly) entails a certain specific theory of persistence, namely perdurantism. That is the usage of 'four-dimensionalism' that I have in mind, and my question is whether the alleged entailment actually holds.

First, I'll set up definitions of 'four-dimensionalism' and 'endurantism' that are as strong as possible without actually making them analytically incompatible. Second, I consider an argument for temporal parts which falls rather naturally out of the definition of 'four-dimensionalism', and reject it as unconvincing. Third, I consider the argument that is most usually given against endurantism, and for temporal parts, the Problem of Change. I offer a new endurantist solution to this problem. With neither argument seeming to offer an apriori connection between four-dimensionalism and temporal parts, I conclude that there is no such connection.

C.1.1 Endurantism

Things are often located at more than one time. Take me, for example: I'm somewhere at this very minute (call that t_1). And I was somewhere five minutes ago (t_0). I might have moved in the intervening time, but you'll find me at both times: both now and five minutes ago. Following the now standard terminology, (JOHNSTON 1987) I'll use the word 'persistence' to cover multiple location in time in this neutral sense.

But people often want to give theories of persistence: and the theories they give fall into two groups: those that believe in persistence with temporal parts, or perdurance, on the one hand, and those that believe in persistence without temporal parts, or endurance, on the other. According to the temporal parts view, the thing that persists through time (me, say) is the sum or composite of the several distinct things each of which occupy just a single one of the times I am located at. These things, my temporal parts, or time-slices, are located at just one of the times at which I'm located (while I am located at many). So, on this view, while I'm multiply located at t_1 and t_0, that's so in virtue of there being some other things, singly located at each of t_1 and t_0, which are my parts.

On the endurantist view, however, this is not the case. According to endurantism, I'm wholly located at both t_1 and t_0, without having a part located at t_1 and not t_0, or a part located at t_0 and not t_1. It's important not to confuse 'wholly located' (which is the opposite of 'partially located') with 'singly located' (which is the opposite of 'multiply located'). Everyone can agree that some things are multiply located in time, that some things persist, in other words. Everyone can agree, too,that some things (be they persisting things, or only the temporal parts of persisting things) are wholly located at certain times. The difference between endurantism and perdurantism is on the issue of whether some things are *both* wholly and multiply located at those times at which they exist. An endurantist says yes, there are, a perdurantist says no.

Sometimes endurantists claim that it's just a big mistake to even speak of temporal parts — that perdurance is not only a false metaphysical view, but an incoherent one. According to P. T. Geach, for example, while speaking of temporal parts is 'very natural', it 'involves an erroneous analysis of propositions into subject and predicate' (GEACH 1968, p. 182). For the purposes of this paper, I'm just going to set aside this line of thought. The reason is that, if correct, it calls four-dimensionalism into question along with perdurantism — this kind of endurantist thinks of time as different from space in such a profound way that they cannot be a four-dimensionalist (and the kind of endurantism I want to defend is a kind compatible with four-dimensionalism).

C.1.2   Four-dimensionalism

The core of four-dimensionalism, as I understand it, is the Dimensionality Thesis: that the universe is a four-dimensional manifold of which one of

the dimensions is time. This doctrine on its own, however, is insufficiently strong to be of much help to us. It's certainly much weaker than what most writers mean by the term 'four-dimensionalism'. So far as I am aware, the closest anyone has come to defending the Dimensionality Thesis on its own, is D. C. Williams on 'the theory of the manifold':

> The theory of the manifold leaves abundant room for the sensitive observer to record any describable difference he may find, in intrinsic quality, relational texture, or absolute direction, between the temporal dimension and the spatial ones   (WILLIAMS 1966, p. 301)

Even Williams, though, goes on the argue that it is unnecessary to add any of the further 'differences' between space and time that he describes here. This is typical — besides affirming the Dimensionality Thesis, four-dimensionalists also claim that time is like space in various different ways.

This second part of four-dimensionalism is responsible for much of its philosophical appeal, as it enables us to solve puzzles and construct arguments about time by appealing to the analogous spatial cases.[2] I will subsume the varying different ways in which four-dimensionalists allege time to be like space under a single vague doctrine, the Analogy Thesis that time is somehow, strongly or weakly, analogous to space.

Four-dimensionalism, then, on my account, is the conjunction of the Dimensionality Thesis with the Analogy Thesis. We must bear in mind, however, that the Analogy Thesis is vague, and can be held in stronger and weaker forms. Accordingly, there will be stronger and weaker versions of four-dimensionalism. I'm going to argue that even the stronger versions of four-dimensionalism are still compatible with endurantism.

C.2   The Argument from Analogy

A version of the Analogy Thesis, in the shape of an analogy between extension in space and persistence through time, is often used to introduce the concept of a temporal part. Here is one example from a recent defence of perdurance by Theodore Sider:

> Persistence through time is much like extension through space. A road has spatial parts in the subregions of the region of space it

> occupies; likewise, an object that exists in time has temporal parts
> in the various subregions of the total region it occupies
> (SIDER 1997, p. 197)

And another from Richard Taylor's classic collection of analogies between space and time:

> [T]he concept of length or extension has a place in both [spatial
> and temporal] contexts, though this is easily overlooked. Things
> can be spatially long or short, but so too they can have a long or
> brief duration, i. e., be temporally long or short.... The notion
> of length in turn leads to that of *parts*, both spatial and temporal
> (TAYLOR 1964, p. 382)

Though these passages may not have been intended as arguments by their authors, they certainly suggest an argument from the Analogy Thesis to the view that things persist by perduring, by having temporal parts. This is the Argument from Analogy:

A1 Time is analogous to space; in particular, persistence is analogous to extension.

A2 All things extend by having different parts at different places.

A3 All things persist through time by having different parts at different times.

Premise A1 here is just a version of the Analogy Thesis. Premise A2 is the observation that macroscopic objects typically do have spatial parts: I fill this bit of space to my left by having my left arm there, and this distinct bit of space, to my right, by having a distinct part, my right arm, there. Each arm extends through its region of space by having many distinct cells as parts, each filling a distinct, smaller region of space, and so on down to the subatomic level.

One thing you might do with this argument, if you wanted to deny the conclusion, is to take it as a modus tollens against premise A1. If you thought that endurantism was more obviously true than the Analogy Thesis, you

might reject or weaken the Analogy Thesis. Such a view might even remain recognisably four-dimensionalist. After all, the Analogy Thesis only asserts some, stronger or weaker, analogy between time and space. A weaker form of the Analogy Thesis could assert that time is just like space, *except* that objects fill time by enduring, while they fill space by having spatial parts. This would still be strong enough to do some work, still allowing arguments from the Analogy Thesis against the passage of time, for example. D. H. Mellor accepts just such a weak version of four-dimensionalism, and argues that it is compatible with special relativity (indeed more compatible than a version including a stronger Analogy Thesis) (MELLOR 1998, pp. 53–56).

This line of argument is unsatisfying for our purposes, as it tends to trivialise our question. Make four-dimensionalism weak enough, and of course it can be compatible with anything you like. So I would like a defence to the Argument from Analogy that allows the Analogy Thesis, and thence four-dimensionalism, to be held in as strong a form as possible.

Suppose that the Analogy Thesis is to be affirmed in a strong enough form to make an analogy between spatial extension and temporal persistence. Now the argument can be treated as a modus tollens against premise A2. Just as there is a debate to be had between endurantists and perdurantists about how things persist through time, there should be an analogous debate to be had about how things extend through space. Analogous to perdurance, we have pertension, filling space by having distinct parts in distinct places; analogous to endurance, we have entension, filling space by being wholly located in each of several places. The defence against the argument from analogy is that just as things might endure through time, they might (and perhaps do) entend through space.[3]

In fact there may be good reasons for thinking that some (if not all) things do entend, especially those things that have no parts — that are 'mereologically simple':[4] the Argument from Avogadro:

V1 All mereological simples are extensionless.

V2 There are only finitely many simples.

V3 All objects are mereological sums of simples.

V4 All objects are sums of finitely many extensionless things. (from V1,V2, and V3)

V5 All sums of only finitely many extensionless things are extensionless.

V6 All objects are extensionless. (from V4 and V5)

V6 is absurd — if it was true, we wouldn't have a problem about whether things entend or pertend! I take this argument as a reductio against V1. It only remains to draw the contradiction explicitly:

V7 But of course some objects are extended!

V8 Some simples have extension; they entend. (reductio against V1)

The most important premise in this argument is V2. I take it that V2 is a discovery of physical science — the discovery of Avogadro's number, the number of hydrogen atoms in a gram of hydrogen. Armed with Avogadro's number, and a theory of the subatomic constitution of matter, we can arrive at a finite total number of the simple objects that make up any ordinary finitely massive material object, like a chair or a table, (or the universe, for that matter).

Substantivalists might object to V2 on the grounds that it counts only the material objects, and not the continuum many point-instants of space-time. For the purposes of this paper, I wish to be neutral on the issue of substantivalism: I am only interested in the manner in which material objects like chairs and tables extend (or persist) and not in the manner in which regions of space-time do so. Plausibly, space-time, if it exists, extends by pertending, and persists by perduring — but that's not the issue here. The argument from Avogadro is intended to be restricted to material objects and material simples, and substantivalist objectors are welcome to substitute throughout 'material simple' for 'simple' and 'material object' for 'object' throughout.

So what are these entending simples? I think that it is most likely that they are the most fundamental objects of physics, leptons and quarks. Current physics regards these objects as mereologically simple (unlike nucleons, such as protons, which are made of quarks), and is silent on whether they are extended — they are, at largest, too small to be practically measurable.[5]

An important thing to note about my argument that quarks and leptons entend is that it has many empirical premises. V2 is an empirical premise; so is the mereological simplicity of quarks and leptons (it may yet be discovered

that they have smaller parts in turn); so too are those things that are known about the extension, if any, of these objects. It follows that whether that some things entend (as I have argued), or whether, on the contrary, everything pertends (in which case V2 will turn out to be false) is an empirical matter. And, if we accept the Analogy Thesis in its strongest form, we should think that the issue of whether anything endures is likewise an empirical matter.

It may be objected here that science is not in the business of discovering which things are mereologically simple. Instead, science discovers which things are, in practice, indivisible. In moving from the in-practice indivisibility of fundamental objects to the view that they are mereologically simple, we cross the boundary from science to metaphysics.

There is a logical gap, to be sure, between on the one hand, the data that we have empirically available to us, about which things are divisible into their proper parts in a laboratory, and on the other, the theories we concoct about which things have proper parts to be divided. But that is no big news: the underdetermination of theory by evidence is ubiquitous in science. If that alone means that science can say nothing about whether an object has parts, then science can say very little.

Moreover, the idea that the nature and number of parts an object has is an empirical matter is quite in line with orthodox mereology. It's a striking feature of classical mereology that it leaves open all questions of whether there are simples, and if so, the nature and number of those simples. Those are questions that involve 'a geometric or at least a topological component, which introduces considerations essentially external to mereology' (Simons 1987, p. 43). It's not to difficult to imagine that such considerations might be, finally, empirical in nature.

The final objection to entension may be that it is absurd, inconceivable, or impossible that something should extend without having parts. One answer to that is that it is conceivable because it is conceived, at least by me, and, indeed, by some other metaphysicians. According to Peter van Inwagen (van Inwagen 1990b, p. 98), Aristotle held that living organisms entend. Hermann Weyl took seriously enough the proposal that some regions of space entend to construct an argument against it: the Tile Argument (Salmon 1975, pp. 65–66), which shows that the Pythagorean Theorem doesn't hold in such spaces. This of course does not affect my proposal, which is that some material objects, not regions of space, entend. In any case, if it were demonstrably true that entension is absurd, the Argument from Analogy would be redundant. Given the Analogy Thesis, for any demonstration of

the incoherence of entension, there should be an analogous demonstration of the incoherence of endurance, which could be used directly.

C.3   The Problem of Change

Many perdurantists take themselves to have such an argument. This is the Problem of Change.[6] It is simple to state. Suppose that a certain thing, a poker, say, is hot at one time, t_1, and later, at t_2, cold. And suppose that we have one standard of heat and coldness in mind here, so that it would be contradictory to say of one thing that it is both hot and cold.

The problem is that it's supposed to be the *very same* poker at t_1 and at t_2. No-one has come along and switched pokers on us. But yet this one object is supposed to be both hot and cold. If I told you that I had a poker that was both hot and cold, I would be contradicting myself. We know that there are no such pokers, nor could there be. But if we believe that things can change, then we must believe that one thing can be both hot (at one time) and cold (at another), and we can say so without fear of contradiction.

This intuitive way of stating the argument has some disadvantages. The emphasis on the self-contradictoriness of 'This poker is both hot and cold' suggests that the problem is a semantic one: 'the problem of specifying the logical form of sentences ascribing temporary intrinsic properties to persisting objects, in such a way that we do not run into contradiction' (LOWE 1988, p. 73). On the contrary, the Problem of Change is supposed to be a serious metaphysical antinomy, which is only to be resolved by adopting a substantive metaphysical doctrine, perdurantism.

To put the problem into sharper focus, let us begin by saying that two things are duplicates if and only if they are intrinsically[7] just alike. Two identical twins are near duplicates, but not quite. Probably the only uncontested instance of genuine duplication that we will ever find is of one thing with itself. For everything is just like itself, nothing can ever be unlike itself.

But it is precisely that one uncontested and uncontestable case that creates problems for us in the case of change. It seems to be essential to intrinsic change, change in temperature for example (or shape, or mass), that the poker of t_2 *not* be a duplicate of the poker of t_1. If the poker of t_2 was a duplicate of the poker of t_1, then one way in which it must duplicate it is the way of temperature. But, by hypothesis, that is not the case. Hence the

poker of t_1 is not a duplicate of the poker of t_2. Hence, since everything must be a duplicate of itself, the poker of t_1 is not the same poker as that of t_2.

To summarise:

C1 The poker of t_1 (P-of-t_1) is hot and the poker of t_2 (P-of-t_2) is cold.

C2 *hence*, P-of-t_1 is not a duplicate of P-of-t_2

C3 *hence*, P-of-t_1 is not identical to P-of-t_2

C4 *hence*, The poker has not endured from t_1 to t_2

C5 *hence*, The poker has perdured[8] from t_1 to t_2

For four-dimensionalists, an important solution to the Problem of Change is not available: the adoption of presentism. Presentists believe that '[o]ther times are like false stories', or like ersatz possible worlds (LEWIS 1986, p. 204). According to them, there is only one real time, the present, and the only things are those things that occupy that time. Supposing that it is now t_2, and the poker is cold, the presentist will deny that there must be a hot poker to account for the fact that the poker was hot at t_1. All that's required is that there be a a false story, or a merely possible world, according to which t_1 is the present, and the poker is hot. The presentist will thus deny C1.[9]

Setting aside the presentist solution, endurantist solutions to the problem of change have a certain general form. Typically, they offer an analysis of premise C1 that is supposed to show how C2 doesn't follow from C1. It's even possible to understand the perdurantist approach to the problem in this way, that is, as offering an analysis of premise C1:

C1p The temporal part at t_1 of P is hot and the temporal part at t_2 of P is cold.

An endurantist does not have to reject this analysis just because it speaks of temporal parts. Provided that the notion of temporal part is a coherent one, it's trivial that everything has at least one temporal part: itself. But the Problem of Change shows that this endurantist reading of C1p is not tenable: since the temporal parts at t_1 and t_2 are not duplicates, they must be distinct. Hence, the poker must have *more* than one temporal part, and the endurantist cannot accept that.

So it seems that we must search for another analysis. One analysis that endurantists offer, and the one I'll offer, is this one:[10]

C1e P has the property of being hot-at-t_1 and the property of being cold-at-t_2.

In this analysis, we've introduced these properties of being hot or cold at such and such a time, which are called temporally indexed properties. There is no impossibility involved in one thing's having both the property of being hot-at-t_1 and the property of being cold-at-t_2 (whereas there would be in one thing's having both the property of being hot-at-t_1 and the property of being cold-at-t_1). If we can understand premise C1 in the way suggested by C1e, the problem of change is no problem. Merely pointing out that this analysis is available, however, is not enough to solve the problem, for two reasons.

First, the analysis of C1 in terms of C1e is compatible with perdurantism. The believer in temporal parts need not deny the reality of temporally indexed properties: they can be identified with the property of having such-and-such a part. The property of being hot-at-t_1, for example, would be the property of having a hot part located at t_1.

Second, supposing we rule out the perdurantist reading of C1e, we are still left with a mystery. We've said what the temporally indexed properties aren't — what *are* they, then? In order to have a genuine rival account to perdurantism, we need to say more about these properties than that they are not the perdurantist's properties of having such-and-such a part. For perdurantists will presumably believe that there are no other plausible candidates.

It is often assumed that the temporally indexed properties must be relational properties: the property, for example, of bearing the external relation 'hot at' to t_1. But if that's right, then a lot of our commonsense judgements about the intrinsicality of heat, charge, mass, and the like will come out to be wrong. And some of those commonsense judgements may be so entrenched that, were we convinced they were false, we would no longer say that there was such a property, as Lewis suggests is the case with shape: 'if we know what shape is, we know that it is a property, not a relation' (LEWIS 1986, p. 204).

C.3.1   Temporally Indexed Properties

If we are to resist the Problem of Change by means of temporally indexed
properties, we had better have an account of those properties to act as a gen-
uine rival to perdurantism. And it had better be possible for those properties
to be intrinsic. Before I state my account, I will first deal with a problem
for any account of temporally indexed properties that takes those properties
to be intrinsic (even the perdurantist interpretation of those properties de-
scribed above). You might think that an indexed property cannot possibly
be intrinsic as it makes essential reference to a moment of space-time. Having
the property of being hot-at-t_1 entails being located at t_1. But being located
at t_1 is extrinsic. Hence, any property the having of which entails that I am
located at t_1, cannot be intrinsic.

The answer to this is that we should understand 't_1', as it appears in the
names of the temporally indexed properties, as a reference to a moment of
time relative to the temporal position of the object that has the property. So
we should understand the property of being hot-at-t_1 as, for example, 'the
property of being an x such that x is hot for the first second of x's life'. The
temporally indexed properties should be understood in a way that makes it
possible for objects located at two different times to share such a property.
If two pokers, created at different times, were to have the same history of
cooling down, and being destroyed, they would share all their temporally
indexed heat properties.

This is just a point about how to understand what is required of a temporally
indexed property, for it to be worthy of that name, and capable of solving
the problem of change. It remains to be shown that there are any such
properties (in whatever sense there are properties), and that they are not
either the property of having a hot part at t_1, or the extrinsic property of
being related in a hot way to t_1. On my account, the temporally indexed
properties are perfectly intrinsic and perfectly non-relational. It's just that
they are disjunctive.

To explain how this is the case, we need to introduce the notion of a distribu-
tional property. The surface of a chessboard has a certain colour distribution.
The property of having *that* colour distribution is a distributional property.
Or, take a poker that is hot at one end, and cold at the other. It has a
certain heat distribution, and has the distributional property of having that
heat distribution. Imagine such a poker, call it a, and another poker, b, which
has a different heat distribution, being uniformly hot, for example. Call the
heat distribution of a, the property A, and that of b, B. Note that these dis-

tributional properties are fully determinate: having any one of them entails that you do not have any other of the same determinable (in this case the determinable property of having some heat distribution). So, for example, that a has A entails that a does not have B.

A and B are both intrinsic properties. Though my description of A involved talking about 'ends' of the poker, it's clear that having A involves nothing outside the poker that has the property. Any duplicates of a would have to also have A, or they would not be duplicates.

Now notice that we can define now up the property of being hot at one end. It is simply having A *or* B *or* any other of the fully determinate heat distribution properties that, as it were, put heat at one end of the object. And this property is intrinsic as well. You can't get an extrinsic property by conjoining or disjoining two intrinsic ones.

A distributional property, then, is a perfectly intelligible kind of property, which everyone ought to believe in to the extent that they believe in any kind of intrinsic property. Disjunctions of them are equally intelligible, and ought to be believed in to the extent that one believes in any disjunctive property.

The disjunctive distributional properties I have just described are spatially indexed properties. For temporally indexed properties, apply this procedure in the temporal case. Imagine now two pokers, one of which begins its life hot, and cools down over time, the other of which remains hot for its entire existence. Call them c and d respectively. Both c and d, we will suppose, begin to exist at t_1, and are destroyed at t_2.

If we are to be four-dimensionalists, in the sense of the Dimensionality Thesis, we will think of c and d as four-dimensional objects, extended over time. Just like a and b, c and d have different heat distributions. c is hot at one end, its earlier end, and cold at the other; d, on the other hand, uniformly hot. Just as before, let us give names to their heat distribution properties: c's can be C, and d's D.

Now we can define up the property of being hot at t_1 as the disjunctive property of having either C or D, or any of those other heat distribution properties that, as it were, place heat at the t_1 end of their instance. Just as in the spatial case, this property is perfectly intrinsic and non-relational. Nor, I think, need it commit us to there being any proper parts of an object which has such a property.

To generalise: wherever we have a temporally indexed property of being X-at-t, we have a number of corresponding permanent distributional properties:

the X-ness distributions. X-at-t is a disjunction of some of those X-ness distributions, the ones that are compatible with being X-at-t.[11]

C.3.2 Can simple objects have distributional properties?

It might be objected that to have a distributional property, an object must be extended, and nothing can be extended without having proper parts. That just takes us back to the argument from analogy, though. I've already argued that we ought to accept the possibility of extension without parts.

But perhaps a weaker objection can be mounted. It might be thought that objects without proper parts can have distributional properties, but only uniform ones. If that is right, then enduring objects cannot change, as to change (in regard of temperature, for example), on my account, is to have a (in our example, temperature) distribution that is non-uniform over time.

This proposal is not plausible, however, once the possibility of extended simple objects has been accepted. If an object has extension, then it must be capable of having a shape; and since it would be arbitrary to insist that a simple object must have any particular shape, it must be capable of having any of the shapes that a similar complex object might have. Thus, it must be possible for it to have a non-uniform cross-section over time. For example, an conical object, with the axis of the cone oriented along the time dimension could be small in the spatial dimensions at one time, then larger at a later time. It would be growing, in other words — it would have a non-uniform spatial size distribution, and that is a counterexample to the proposal under consideration.

C.3.3 What unifies the distributional properties?

One might still be a little suspicious about the theory just advanced. One common suspicion runs like this: What is it that unifies the disjuncts of an indexed property? The only way I've been able to tell you what the disjuncts of, for example, being hot at t_1, are, is by using phrases like 'those heat distributions which place heat, *as it were*, at the t_1 end of their instances'. But this seems a little circular. Which exactly are those heat distributions? And is there a way of answering this question without speaking of 'ends', which in this context must surely be parts?

I don't see any reason to suppose so. But that shouldn't be a problem. Or if it is, it's only a problem in explaining the theory, rather than a problem in the theory itself. There are certainly those distributional properties, in whatever sense there are properties at all; and there are certainly all sorts of arbitrary classes of those properties, in whatever sense there are classes. Among those classes is the one I'm calling 'the class of all those distributional properties that place heat *as it were* at the t_1 end of their instances', and no point about the language I'm using to describe the class can show that if any object has one of the members of that class, then it must have some proper part.

By way of analogy, imagine the class of heights that have been the exact height of Socrates at midnight on some night. There is probably no other way of describing that class except in the way I just did, but it would be a mistake to think that those heights could only be had by anything that shared a universe with Socrates, or that Socrates must exist in order for that class to exist. There is even the disjunctive property of having one of those heights, (in whatever sense there are disjunctive properties), and again, it is a property that could be had without there being Socrates. The problem here is just that finite creatures such as ourselves don't have the language to name and list all the disjuncts.

Nobody would make this mistake about the class of midnight heights of Socrates — why then does it seem tempting in the case of indexed properties? Perhaps what is really at the back of the mind of someone who objects that they cannot see what unifies the classes of distributional properties is a deeper metaphysical objection about resemblance: Let us return to my example of the two pokers, c, which is hot at t_1, and cold at t_2, and d, which is uniformly hot. These pokers are alike in a restricted way, namely in that they are both hot at t_1. On my account, the pokers share an indexed property.

These indexed properties are supposed to be disjunctive. But there is an influential tradition (ARMSTRONG 1978B; LEWIS 1983B) claiming that two objects can only resemble each other in virtue of their both possessing some non-disjunctive property. This might seem plausible: a raven and a writing-desk do not resemble each other merely in virtue of their sharing in the property of being either a raven or a writing-desk. There may be some cases where two objects *seem* to resemble each other in this way. For example, two birds might resemble each other in virtue of being either a raven or a crow. But in every such case, so runs the standard story, we will find that the resemblance is subserved by some resemblance in a non-disjunctive respect, in this case, in both birds being corvids, corvidity being a non-disjunctive

property.

Of course, this will not be the case for c and d, if c and d have no parts. c and d have entirely distinct distributional properties, C and D, recall. And they need have nothing else in common, save for the disjunctive distributional property of having either C or D. But that's precisely what the traditional account of resemblance rules out. We cannot believe that c and d resemble each other in virtue of being hot at one end, if we think that an indexed property is simply a disjunctive distributional property, not subserved by any non-disjunctive property of parts of the objects in question.

This is a way of making precise the worry about what unifies the disjunctive properties. If you believe the key premise, that resemblance is to be explained by shared non-disjunctive properties, you will be worried by the possibility that things might resemble each other by sharing a temporally indexed property, and that, in that case, temporally indexed properties cannot be analysed disjunctively, as I have done.

One answer to this objection is just to deny the premise, the traditional theory of resemblance. We could replace it, for example, with a natural class theory, according to which things resemble each other in virtue of being in a natural class together. Since classes are extensional, there's no distinction between a disjunctive and and non-disjunctive class. If indexed properties are natural classes, that will explain the resemblance.

We don't need to do this, though. The problem I face here is one that will recur for someone who holds the traditional theory anyway. It is the problem of fundamental determinates. I'm going to use an example from subatomic physics, because that's where we'll find uncontroversial examples of fundamental properties and objects. There are seven charges that a fundamental particle can have: 1, 2/3, 1/3, 0, -1/3, -2/3, and -1.[12]. Take an electron (with charge -1) and a down-quark (with charge -1/3). Electrons resemble down-quarks in charge (both their charges are negative) — but not in virtue of having a charge in common — the fundamental charges of -1 and -1/3 are quite as distinct as the fundamental charges of -1 and 1. Rather, they resemble in virtue of having similar charges.

This case is quite analogous to the case of the two pokers. c and d resemble not in virtue of having a temporally indexed property in common, but in virtue of having similar distributional properties. D is more like C than like, say, the property of being uniformly cold. Hence d will resemble (as regards temperature) c more than it resembles any poker that remains cold throughout its life. Just as any given electron will resemble (as regards

charge) any given down-quark more than it resembles (as regards charge) any given positron.

This is an independent problem that also stands in need of a solution. Whatever that solution is, it can be applied to temporally indexed properties as well.

C.4   Conclusion

A four-dimensionalist can accept the account of endurance described above. This fact will be of interest to three groups of people. First, there are the endurantists who may wish to take up four-dimensionalism, the four-dimensionalists who may wish to take up endurantism, and uncommitted folk who may wish to take up both. I heartily recommend the doctrines I have described to such people. They will, however, to judge by the current literature, be in the minority.

Second, there are the perdurantists who, hitherto, have been in the uncomfortable position of having to defend their view as not only true, but a truism. Lewis, for example, says:

> I too would welcome a fourth solution, but for quite a different reason. If [perdurantism] alone is tenable, then our commensense belief in persisting things commits us implicitly to perdurance — and this despite the fact that some of us firmly reject the notion of temporal parts... and many more have never heard of it!
> (LEWIS 1988, p. 76)

Such perdurantists will be only too happy to have a rival account of persistence made available; though they may have to find new and more substantive arguments to show that it is false without showing that it is incoherent.

Third, there are those endurantists who argue against four dimensionalism by arguing against perdurantism. Judith Jarvis Thomson, for example, argues against the Analogy Thesis, on the grounds that it entails perdurantism, which she dismisses as a 'crazy metaphysic' (THOMSON 1983, p. 213). This line of argument clearly cannot work if the entailment is false, as I have shown.

A consistent four-dimensionalist should, inspired by the Analogy Thesis, take the same attitude to temporal parts as to spatial parts. Since, as I have argued, it is an empirical matter whether any given object has spatial parts, we should likewise think it an empirical matter whether any given object has temporal parts. It is a difficult question how we might find out which things perdure and which endure; but that is a different issue from whether either is possible.[13]

Notes

[1]This point is not unknown to those writers who use the terms in this way. Theodore Sider, for example, after announcing that he will use 'four-dimensionalism' and 'three-dimensionalism' to mean the same as 'the theory that things perdure' and 'the doctrine that things endure' respectively, says 'We need to look carefully into just what three- and four-dimensionalism amount to. These names for the doctrines... are poor guides' (SIDER 1997, pp. 197–198). Peter van Inwagen, who uses a Flatland scenario much like the one I describe, uses scare quotes around 'three-dimensionalism' and 'four-dimensionalism' to highlight their strangeness in that context (VAN INWAGEN 1990A). Trenton Merricks says that he uses the terms 'four-dimensionalism' and 'perdurantism' interchangeably while noting that he does *not* take them to mean the same, for similar reasons (MERRICKS 1995, p. 525n).

[2]J.J.C. Smart is one of the great masters of this technique: '[I]f time flows, how fast does it flow? Does it flow at one second per second? ... Does my ruler advance at one centimeter per centimeter?' (SMART 1989, p. 34) And on temporal parts: '[Endurantists] may object that according to [perdurantism] we would never see (say) a tomato, because the tomato, as four-dimensional entity would extend into past and future.... in consistency, [endurantists] should say that you never see tomatoes but only their facing surfaces' (SMART 1989, p. 19–20). Richard Taylor lists a number of analogies between space and time in his (1964), among them an analogy between extension in space and persistence through time. This analogy is clearly important for our purposes. It is made the sole content of four-dimensionalism by Mark Heller, whose 'minimal four-dimensionalism' is the thesis 'that persisting objects extend over time in the same way they extend over space' (HELLER 1993, p. 49). It is hard to know what this would mean outside of the context of the Dimensionality Thesis. If time were not a dimension, it is hard to see how objects could 'extend' over it in the same way they extend through the spatial dimensions - so I take it that Heller implicitly endorses the Dimensionality Thesis too.

[3]I have earlier cited Peter van Inwagen as someone who uses 'four-dimensionalism' to mean perdurantism. Interestingly, however, if the distinction between entension and pertension is allowed, his definition of 'four-dimensionalism' becomes equivocal. According to him, four-dimensionalism is the view that 'persisting objects are extended not only in the three spatial dimensions, but also in a fourth, temporal dimension, and persist simply by being temporally extended' (VAN INWAGEN 1990A, p. 245). If his 'extended' is taken to mean my 'pertended', then his 'four-dimensionalism' is the Dimensionality Thesis plus perdurantism, which makes it a trivial truth in his usage that a four-dimensionalist must

be a perdurantist. On the other hand, if his 'extended' is taken to mean my 'extended', his 'four-dimensionalism' is the Dimensionality Thesis, plus a certain restricted analogy between time and space, specifically between persistence and extension. On this latter reading it is no trivial matter that a four-dimensionalist must believe in temporal parts.

[4] I make some minor use of mereological concepts such as summation in the remainder of this section. The concepts I have in mind are those of the 'classical' mereology, also known as the 'Calculus of Individuals' (GOODMAN 1951, pp. 42–51). This is also the mereology standardly used by perdurantists such as Lewis (1986, p. 69n). For a comprehensive survey of mereology, including non-classical theories, see Simons (1987).

[5] For a readable introduction to the physics of quarks and leptons, see Fritzsch (1984). On the radius of electrons, and the practical difficulties of measuring it, see Ridley (1995, pp. 133–138).

[6] For an influential statement of the problem, see Lewis (1986, pp. 202–205) and responses to it, some of which can be found in Lowe (1988, 1987b); Lewis (1988); Mellor (1998); Haslanger (1989).

[7] I won't attempt to exactly explicate the idea of intrinsicality here. For an attempt at definition in modal terms, though, see Langton and Lewis (1998).

[8] The move from C4 to C5 deserves more attention than I can give it here. I assume that endurantism and perdurantism are the only available accounts of persistence. There are other possibilities, among them the simple denial that anything persists.

[9] Carter and Hestevold (1997) offer an interesting variant: they claim to deduce perdurantism from 'Static Time', the view that 'objects and events undergo no temporal becoming'. They argue that Static Time entails a thesis they call 'Temporal Parity', which functions to rule out presentist solutions in the same way that four-dimensionalism does.

[10] The major competing analysis indexes not properties, but the instantiation relation that holds between the properties and their instances. (As in Lowe's 'solution (ii)' (LOWE 1988)). I fear that allowing an instantiation relation to do real explanatory work courts Bradley's famous regress of relations (BRADLEY 1897, pp. 17–18), as is suggested by Armstrong's arguments against 'relational realism' (ARMSTRONG 1978A, p. 106), those forms of realism that have this feature. This worry aside, the motivation for instantiation indexing is that it avoids any pressure to think of indexed properties as relational or extrinsic — but I will argue that there need be no such pressure in any case.

[11] 'What of being hot *simpliciter*?' it may be asked. I have nothing very interesting to say about 'hot *simpliciter*' — it's not clear to me that it means something unambiguous. If it means hot in the way that a three-dimensional temporal part of a poker would be hot, then enduring things don't have such properties; but neither do perduring things. If it means hot, as it were, at some time, then it is just a very disjunctive heat distributional property. If it means hot, as it were, at every time, then it is a less disjunctive one (even the property of being permanently hot must be disjunctive, as there are many different temperature distributions that are non-uniform in different ways across space, even if they are uniform along the time axis).

[12]The unit here is e, the charge on an electron — or on a positron, strictly speaking, as an electron is usually said to have charge -1

[13]Thanks for comments on and discussion of this paper go to David Armstrong, Helen Beebee, John Bigelow, Vera Koffman, David Lewis, Neil McKinnon, Daniel Nolan, Barbara Nunn, Ted Sider, Jack Smart, Kim Sterelny, Daniel Stoljar, and two anonymous referees for the Monist.

Appendix D

Intrinsic

In their paper "Defining 'Intrinsic'" Rae Langton and David Lewis propose
a definition of intrinsicality in terms of modality and naturalness. Their
key idea, drawing on earlier work by Jaegwon Kim, was that an intrinsic
property is one that is independent of accompaniment, which is to say that
P is intrinsic iff the following four conditions are all met:

1 It is possible for a lonely object to have P.

2 It is possible for an accompanied object to have P.

3 It is possible for a lonely object to lack P.

4 It is possible for an accompanied object to lack P.

Langton and Lewis say that an object is "accompanied" iff it coexists "with
some contingent object wholly distinct from itself." (LANGTON AND LEWIS
1998, p. 333) A "lonely" or "unaccompanied" object is one that is not
accompanied. We will also speak of an object being "accompanied by an F"
iff it coexists with some F wholly distinct from itself.

This works very nicely for the obvious examples. It works for *being cubical*,
being 50 km from a capital city, and *being lonely* (intrinsic, extrinsic, extrinsic, respectively). But it doesn't work for every property. Langton and Lewis

note that disjunctive properties cause trouble: they give the example of *being cubical and lonely, or else non-cubical and accompanied*. This property is independent of accompaniment, but intuitively is extrinsic. Other disjunctive properties are intuitively intrinsic (the property of *being cubical or spherical*, for example), so a new test must be prescribed for them.

And that is, indeed, what Langton and Lewis do: they call the non-disjunctive intrinsic properties "basic intrinsic", and apply the independent of accompaniment test to them. So, a property is basic intrinsic iff it is:

1 not a disjunctive property, and,

2 not the negation of a disjunctive property, and,

3 independent of accompaniment.

They then define the relation of intrinsic duplication as the relation that holds between two objects iff they share all their basic intrinsic properties, and an intrinsic property as one that can never differ between intrinsic duplicates (actual or possible). Equivalently, one could say that an intrinsic property is one that supervenes on the basic intrinsic properties of its object. Intrinsic in this sense is applicable to even disjunctive properties.

Unfortunately there is a problem that the Langton-Lewis analysis cannot deal with. It has to do with the way that Langton and Lewis use the notion of a disjunctive property. As they themselves point out, it is no trivial matter to define what it is for a property to be disjunctive. They offer the following analysis:

> Given some or other notion of natural properties, let us define the disjunctive properties as those properties that can be expressed by a disjunction of (conjunctions of) natural properties; but that are not themselves natural properties. (Or if naturalness admits of degrees, they are much less natural than the disjuncts in terms of which they can be expressed). (LANGTON AND LEWIS 1998, p. 336)

Two presuppositions of this definition are worth mentioning here. First, it is presupposed that there is some distinction between natural and unnatural properties to be made. Lewis and Langton are explicit about this, and invite the reader to substitute in her favourite account of this distinction.

They offer some examples of the sorts of accounts that they have in mind, including ontologies of sparse universals or tropes; accounts that posit an undefined naturalness of certain classes; and accounts that define naturalness of properties in terms of the importance of the role those properties play in our thinking. This will be important later, as we will argue that Langton and Lewis may be leaning too hard on this distinction; that not every account of it can do the work they need.

Second, it is presupposed that the individuation conditions for properties are coarser than the individuation conditions of predicates. There would be no point in speaking of "those properties that can be expressed" by disjunctive predicates unless it were possible that a property have multiple expressions, some disjunctive and some not. We take it that the intended individuation conditions of properties are along the extensional lines Lewis has endorsed elsewhere. (LEWIS 1986, p. 50) Properties are construed as sets of possible individuals: same set of individuals, same property.

Now at last we are in a position to state the problem. We think that Langton and Lewis were mistaken to identify the properties that cause problems — that is, the properties that are capable of being extrinsic even though they are independent of accompaniment — with the disjunctive properties. We have a counterexample: a property that is extrinsic, independent of accompaniment, and not, we think, disjunctive in Langton and Lewis's sense. (Nor is it the negation of an Langton and Lewis disjunctive property). It is the property of *being such that there is a cube*.[1]

This is, to be sure, a silly property that only a metaphysician would ever think of. But the same is true of the example that motivates Langton and Lewis to deal specially with disjunctive properties. If the aim of the game was to deal only with non-silly properties, the independent of accompaniment test would suffice. Moreover, it would become crucial to have an account of which properties are silly, and our point could easily be restated as the point that not all of the silly properties are disjunctive. And finally, as an ad hominem point, notice that there is such a property according to the second presupposition of the Langton/Lewis analysis. It is the set of all the members

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[1]As with many counterexamples, once you see how to do it, they're easy to make up. Other examples include: *being such there is an electron*; *being holy*, where to be holy is to be such that God exists (Rudolf Otto may have had such a view of the holy — thanks to Winifred Lamb for this point). There are also relational variants: *touching a head*; *being within 5m of a philosopher*. One important feature of these is that, unlike the original counterexample, they are possessor-dependent — they can be had by some actual thing without being had by every actual thing.

of all the possible worlds that contain a cube.

We think that it is as obvious as anything in this area could be that our property is extrinsic.[2] Nevertheless it is independent of accompaniment. All the required possibilities are there, realised by the following possible worlds:

    1 A world containing nothing but two cubes.

    2 A world containing nothing but one cube.

    3 A world containing nothing but two non-cubes.

    4 A world containing nothing but one non-cube.

And we do not think it is disjunctive either. It does have a disjunctive expression: "being either a cube or accompanied by a cube". But it is not obvious to us that this is a disjunction of natural properties. *Being a cube* is a natural property (let's suppose), but we have simply no idea whether *being accompanied by a cube* is natural. Even if it is, it seems no more natural than *being such that there is a cube*. (Though both are, we suppose, less natural than *being a cube*.) So our property is not disjunctive, by the lights of the definition above.

Even putting our intuition that the counterexample property is no less natural than its supposed disjuncts aside, there is a deeper problem here than a mere counterexample. For Langton and Lewis to defend their analysis, they need to appeal to fairly obscure judgements about the relative naturalness of properties[3] — but they don't have the resources to make these judgements. One of the virtues of their account is meant to be its robustness in the face of different ways of drawing the distinction between natural and unnatural

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    [2]If it's possible to make sense of local intrinsicality (HUMBERSTONE 1996, pp. 206, 227–228) — of a property being intrinsic-to this object, but extrinsic-to that one — then *being such that there is a cube* is intrinsic-to some things, namely, the cubes. But it is extrinsic-to all the non-cubes, and, plausibly, the intrinsic properties are those which are necessarily intrinsic-to all their instances.

    [3]The obscure judgements about relative naturalness appear in examples that Langton and Lewis use themselves — they appear, for example, to be committed to the view that *being both red and accompanied by a red thing* is more natural than the *being not the only red thing*, which they regard as disjunctive. (LANGTON AND LEWIS 1998, p. 335n) Stephen Yablo has also complained about this example. His worry is that the very "clearcut" fact that *being the only red thing* is extrinsic ought not to be analysed in terms of the "controversial and (apparently) irrelevant" facts about relative naturalness. (YABLO 1999, p. 481)

properties. Langton and Lewis assert that most philosophers will be willing to help themselves to some or other version of the distinction, and that any such version will work when substituted into their account. But not every such distinction will provide what they need — the relative naturalness of *being accompanied by a cube* and *being such that there is a cube* are not among the Moorean facts of naturalness that we expect any account of natural properties to explain.

Nor do the needed facts about relative naturalness obviously fall out of the types of theory of naturalness Langton and Lewis suggest. If the sharing of natural properties makes for resemblance, for example, (as is suggested by at least one of the candidate theories of naturalness, Armstrongian realism about universals), neither property is any more or less natural than the other. Two things that are both accompanied by a cube don't seem to be any more or less objectively similar in virtue of that than two things that are both such that there is a cube.

Alternatively, if the naturalness of properties is grounded in the importance of the role those properties play in our thinking, again the needed judgements about relative naturalness are unforthcoming. There seems to be no reason to hold that *being accompanied by a cube* plays a more important role than *being such that there is a cube.*

So, the Langton/Lewis analysis of "intrinsic" faces two problems. The first is a straight counterexample — if you believe our weak intuition that *being accompanied by a cube* is no more natural than *being such that there is a cube*, their analysis will make the latter intrinsic. The second is that there doesn't seem to be any particular theoretical reason to overthrow that intuition. If the Langton/Lewis analysis of "intrinsic" is to resist our counterexample, it will need supplementation with a theory of naturalness that is, as yet, unarticulated.[4]

Appendix E

The A-theory

Unpublished paper entitled "A-theory for B-theorists" (Parsons 2001a)

Because the notes to this appendix are quite lengthy, I have gathered them at the end of the appendix, rather than placing them at the foot of the page they belong to.

The debate between A-theory and B-theory in the philosophy of time is a persistent one. It is not always clear, however, what the terms of this debate are. A-theorists are often lumped with a miscellaneous collection of heterodox doctrines: the view that only the present exists, that time flows relentlessly, or that presentness is a property (Williams 1996); that time passes, tense is unanalysable, or that earlier than and later than are defined in terms of pastness, presentness, and futurity (Bigelow 1991); or that events or facts (as opposed to language) are "tensed" (Mellor 1993). B-theorists then argue that the A-theory is incoherent, using variants on J.M.E. McTaggart's argument for the unreality of time (McTaggart 1927, ch. 33).

While I am a card-carrying B-theorist, it strikes me that there is something unfair about this procedure. We should be very surprised to find a single doctrine (as opposed to a large system) incoherent in itself, especially one as popular as the A-theory. In this paper, I argue that the A-theory can be distinguished from the miscellaneous doctrines with which it is often associated (section E.1); and that, once so distinguished, it is not shown to be incoherent by the standard arguments (section E.2).

Finally, I argue, assuming the A-theory, for a comprehensive theory of time that also includes two important doctrines that are more usually held by

B-theorists: realism about the past and future, and an indexical analysis of tense (section E.3). This is the comprehensive A-theory that should be most plausible by the lights of a B-theorist; the "A-theory for B-theorists". Since, as I will argue, it is plausible that ordinary language contains an implicit commitment to the A-theory, it is a strong contender for the "folk theory of time": the comprehensive theory of time implicit in ordinary language.

E.1   What is the A-theory?

According to the A-theory of time, there are intrinsic and monadic properties such as *pastness*, *presentness*, and *futurity*, and it is in virtue of having such a property (an "A-property") that things in time are past, present, or future. Because things are past and future to many different degrees (Aristotle is more past than Kant, for example) there are, according to this theory, many such properties, corresponding to the different degrees to which things can be past or future.

This idea orginates in the philosophical literature with McTaggart, from whose "A-series" and "B-series" the terms "A-theory" and "B-theory" were subsequently derived. McTaggart says:

> I shall give the name of the *A* series to that series of positions which runs from the far past through the near past to the present, and then from the present through the near future to the far future, or conversely. The series of positions which runs from earlier to later, or conversely, I shall call the *B* series.   (McTaggart 1927, s. 306)

McTaggart's usage makes it clear that he intends the A-series to be, by definition, irreducible to the B-series. To believe that the A-series positions (the A-properties, that is) reduce to B-series ones, is to believe in only a B-series and not an A-series. This is why the A-properties are, by definition, intrinsic and monadic: it rules out a reduction to the relations that are used to generate the B-series.[1]

Some A-theorists hold that these "B-relations", *earlier than, later than*, and *simultaneous with*, should be defined in terms of the A-properties in the way that the relation *taller than* can be defined in terms of individual heights. However, it's possible to believe in A-properties and reject this reduction, or

simply take no position on it. The A-theory doesn't say anything either way about B-relations. I will use the term "B-theory" to mean the denial of the A-theory. The B-theory is the view that there are no A-properties of the kind an A-theorist believes in.

A-properties are had by anything that is in time. I wish to remain as neutral as possible about such issues as the nature of events, whether relationalism or substantivalism is true about time, and so on, but I take it that if there are events (as distinct from substances) or moments of time (as distinct from substances or events occupying those moments) then all these things are capable of having A-properties. Though McTaggart spoke of the things that have the A-properties as "events", by this he meant simply the "contents of any position in time" (MCTAGGART 1927, s. 306). So, in allowing anything that is in time to be the instance of an A-property, I am simply following him.

E.1.1   The Orthogonality of the Debate

It is terribly important to distinguish the A-theory, thus described, from any other theory of time that might be endorsed by someone who believes the A-theory. Just as not everything believed by any given scientist is science, not everything believed by any given A-theorist is A-theory. The failure to attend to this point has been responsible for much confusion in the literature, of which a typical instance is Clifford Williams' article "The Metaphysics of A- and B-time".

Williams considers a number of distinctions between different comprehensive theories of time: for example, the distinction between comprehensive theories that assert that time passes "relentlessly" (WILLIAMS 1996, p. 378) versus those that deny this; or that between comprehensive theories that assert that only the present exists, versus those that deny this. He also considers the distinction I have drawn above, between theories that assert that there are A-properties versus those that deny this.

He concludes that there is, in the end, no distinction between A-theory and B-theory: but what he is looking for in the A-theory is a comprehensive theory of time that asserts that time passes "relentlessly" *and* that only the present exists, *and* that there are A-properties. This is made clear by his criticisms of the view that the A-theory is the doctrine that there are A-properties:

> The most common way to think of A-time is to think of it as events possessing properties that events in B-time do not possess, namely pastness, presentness and futurity...
>
> [T]his way of differentiating the two theories... makes A-time just as spread out as B-time. In order for an event to have a property it must exist in some sense. So the picture we obtain of A-time is one in which past, present, and future events are equally real in some sense...
>
> [I]t is not evident how the shift of presentness from event to event in A-time differs from the transition from occurence to occurence in B-time.   (WILLIAMS 1996, p. 379–380)

Williams' objection to the "common way of thinking of A-time" is that it is not equivalent to other doctrines that might be believed by individual A-theorists: that only the present is real, and that time passes in some sense supposedly denied by B-theorists. But why should this inequivalence show that there is no distinction between the A-theory and the B-theory?[2]

The moral of Williams' mistake is that we should understand the A-theory / B-theory debate as orthogonal to these other issues. If we conflate the A-theory with the view that time passes, only the past exists, or that tense is unanalysable, we will end up in the same position as Williams, unable to distinguish A-theory from B-theory, as there are recognisable A-theories and self-ascribing A-theorists who deny these other theories.

E.1.2   Motivating the A-theory

The attraction of the A-theory is that it makes the question of which time is present — that is, of what time it is — into an question about a ordinary matter of fact. To an A-theorist, the fact of what time it is is just like the fact of what time contained dinosaurs. The dinosaurs might have been at a different time; and likewise, says the A-theorist, the present might have been at a different time.

The A-theory can allow that which time is present is contingent; and that there are true and non-trivial counterfactual conditionals such as "if it were 5 o'clock, I would be at the dentist." The B-theory has trouble with the semantics of "if it were 5 o'clock, I would be at the dentist", because, on the

B-theory, the antecedent of that sentence doesn't correspond to a way the world might be. On the standard Lewis-Stalnaker semantics for counterfactual conditionals, this counterfactual is true just if all the nearest possible worlds where it is 5 o'clock are worlds where I am at the dentist. (LEWIS 1986, pp. 20–27) According to the B-theory, however, it doesn't make sense to speak of a world where it is 5 o'clock, so the standard semantics cannot be applied.

Moreover, the A-theory can allow that which time is present changes — that not only could it have been a different time, but that it *will be* a different time in the future; and that it *was* in the past. That which is present will be past, and has been future. Again, it's not clear what sense the B-theory can make of this.

The A-theory has ramifications for the interaction between the metaphysics of time and some ethical issues. In a example of Derek Parfit's, you are asked to imagine that you awake in a hospital ward with amnesia. You are reliably informed that you are either a patient whose long and painful operation was performed yesterday, or a patient whose short and less painful operation will be performed tomorrow. Which would prefer to be the case? Most people would rather be the first patient, even though the first patient suffers more, *ceteris paribus*, than the second. It is hard for a B-theorist to resist the conclusion that this is irrational. (PARFIT 1984, s. 64) The A-theorist, however, can adopt a very simple solution to this puzzle by holding that future pains are intrinsically worse than past ones, merely in virtue of being future.

These considerations are not intended to be knockdown arguments, but only motivations. As I said, I am not an A-theorist, so I will leave arguments for the A-theory (as opposed to defence of it from criticism I regard as unsound) to those who actually endorse it.

E.2   The Trouble with the A-theory

Standard objections to the A-theory are all variants of McTaggart's famous argument for the unreality of time. McTaggart presents a reductio argument against the existence of A-properties. Its conclusion is clear enough:

> Past, present, and future are incompatible determinations. Every
> event must be one or the other, but no event can be more than

one.... The characteristics, therefore, are incompatible. But every
event has them all.   (MCTAGGART 1927, s. 329)

The contentious aspect of McTaggart's argument is whether this contradic-
tion can in fact be reached from the A-theory. In the following three sections,
I discuss three ways to understand McTaggart's argument for this conclusion:
as a version of the problem of intrinsic change (section E.2.1); as a problem
to do with tense (section E.2.2); and as a problem to do with the passage
of time (section E.2.3). I argue that none of these pose a problem for the
A-theory.

E.2.1   The Problem of Change for A-properties

It's tempting to interpret McTaggart by subsuming his argument into the
problem of intrinsic change, or of temporary intrinsics. This latter problem
is the problem of explaining how it can be that one object has incompatible
properties at different times, as seems to be required by intrinsic, or not-
mere-Cambridge, change in objects.

For example, a poker cools down. At time t_1 it is hot, at t_2 it is cold. For this
to count as an intrinsic change in the poker, it must be the same poker at
both times. If I have two pokers, one which exists at t_1 and is permanently
hot, and the other of which exists at t_2 and is permanently cold, neither
poker changes as regards temperature. On the other hand, it also seems that
it can't be the same poker at both times — for no one poker can be both hot
and cold. If I told you I had a poker that was both hot and cold, I would be
contradicting myself.

The problem asks us what's wrong with the inference from 48 and 49, below,

48 The poker is hot at t_1.

49 The poker is cold at t_2.

to the inconsistent pair 48′ and 49′:

48′ The poker is hot.

49′ The poker is cold.

This problem has standard answers: one idea is that, strictly speaking, pokers aren't wholly hot or cold. Rather they are partially hot or cold. It is no contradiction for me to have a poker that is both partially hot and partially cold. It could be hot at the end that was resting in the fire, and cold at the handle. The answer to the problem of intrinsic change for poker temperature is to extend this idea to time. The tip of the poker and the handle of the poker are distinct spatial parts of the poker. We can think of the hot "poker" at t_1 and the cold one at t_2 as distinct *temporal* parts of the poker. Though the poker might seem wholly hot at t_1, it is not — it has later parts which are cold. So the contradiction can be resolved by the acceptance of temporal parts of persisting objects.[3]

The effect of this solution is that the inference from 48 and 49 to 48′ and 49′ is valid, but 48′ and 49′ are themselves ambiguous between a reading that makes them an inconsistent pair, and a reading that makes them compatible. If we read "hot" and "cold" as "partially hot" and "partially cold" respectively, neither 48′ and 49′ nor 48 and 49 are inconsistent. And it is only this reading of 48 and 49 (according to the solution under consideration) that is required in cases of change.

The problem of intrinsic change for temperature has an analogy for A-properties. A-properties are, like temperatures, intrinsic properties, and different A-properties are had by persisting objects at different times. And, as McTaggart reminds us, past and future, are, like hot and cold, incompatible. So the problem I have just described arises for them.

Suppose we add to the previous example the claim that t_1 is a past time, and t_2 a future time. Since the poker is at a past time, namely t_1, the poker exhibits the A-property of pastness (if there are any such properties). However, the poker is also at a future time, t_2, so it exhibits the A-property of futurity. We can set up two sentences analogous to 48 and 49:

50 The poker has pastness at t_1.

51 The poker has futurity at t_2.

Because these sentences are analogous to 48 and 49, there is an analogous problem about whether they entail the inconsistent pair 50′ and 51′:

50′ The poker has pastness.

51′ The poker has futurity.

This problem has an analogous answer. When McTaggart says that being past and being future are incompatible properties, of course he means being *wholly* past and being *wholly* future. There is no contradiction in one thing's being partially past, and partially future, and indeed partially present — these properties are compatible, and all three are had by the poker in my example.

William Lane Craig, who holds that McTaggart's Paradox is a "special case" of the problem of intrinsic change, has argued that this answer will not work in the case of A-properties. (CRAIG 1998) Craig points out that McTaggart's Paradox can arise for things which do not persist, and which, therefore, do not have temporal parts. So there are cases of McTaggart's Paradox which can't be solved by appeal to temporal parts. To put this another way, McTaggart's Paradox poses problems over and above those posed by the problem of intrinsic change (as I will be arguing myself in the next section). So Craig's argument against temporal parts solutions undercuts his own attempt to subsume McTaggart's Paradox into the problem of intrinsic change.

Though the problem of intrinsic change is a very serious one, and I don't pretend that I've conclusively solved it here, my point is not that it poses no problem to the A-theory. Rather, it poses *exactly the same problem* for the A-theory as for everyone else. Stock solutions to the problem of change which B-theorists happily help themselves to work in exactly the same way for A-theorists. The problem of intrinsic change, therefore, cannot be regarded as a reductio against the A-theory in particular.

E.2.2   McTaggart's Paradox

In any case, the problem of intrinsic change is not what McTaggart had in mind. The reason that McTaggart actually gives for thinking that each event must have every A-property is *not* that events persist from the past through the present and into the future, having different A-properties at different times, but that the A-properties an event has at future or past times are not those that it will have, or did have, at those times:

> If M is past, it has been present and future. If it is future, it will be present and past. If it is present, it has been future and will be past. (MCTAGGART 1927, s. 329)

McTaggart is not saying here that present persisting things are (partially) past and future — but that present things will, in the future, be wholly past.

There is a way of making this point that departs a little from McTaggart's way of stating it, but which makes it very clear that there is a problem here that is additional to the problem of intrinsic change. The problem of intrinsic change was solved by showing that, while there is a contradiction between one thing's being wholly past and wholly future, there is none between one thing's being partially past and partially future. But consider a time before the poker of the previous section ever came into existence. Then, the poker was wholly future, including, even, all of its temporal parts. Now consider a time after that very poker has been destroyed. At that time, the poker will be wholly past, including, even, all of its temporal parts.

For this reason the very same poker seems to be both *wholly* past and *wholly* future, properties which are genuinely incompatible (unlike the properties of being partially past and being partially future).

The crucial part of McTaggart's argument is his move from past and future tensed sentences such as

52 M was wholly future.

53 M will be wholly past.

to the grammatically present tense (though presumably tenseless)

52′ M is wholly future.

53′ M is wholly past.

While 52′ and 53′ contradict one another, 52 and 53 don't obviously do so. The move from 52 and 53 to the inconsistent pair 52′ and 53′ is licensed by McTaggart's analysis of tense:

> When we say that X has been Y, we are asserting X to be Y at a moment of past time. When we say that X will be Y, we are asserting X to be Y at a moment of future time. When we say that X is Y (in the temporal [ie. the present tense, as opposed to the tenseless] sense of "is") we are asserting X to be Y at a moment of present time.   (MCTAGGART 1927, s. 331)

What McTaggart is doing here is offering an analysis of tense in tenseless terms, against the background of the A-theory:

> X will be Y iff
>> there is some future time t_f such that X is Y at t_f
>
> X is-now Y iff
>> there is some present time t_n such that X is Y at t_n
>
> X was Y iff
>> there is some past time t_p such that X is Y at t_p

McTaggart can thus analyse 52 and 53 as

52* M is wholly future at a past time.

53* M is wholly past at a future time.

He then infers the inconsistent pair, $52'$ and $53'$, from 52* and 53*.

On my reconstruction, McTaggart's argument that A-properties involve a contradiction has two steps. The first step is the move from the tensed sentences 52 and 53 to the tenseless, but time-indexed 52* and 53*. The second step is the step from the time-indexed sentences to the inconsistent pair $52'$ and $53'$. Doubts might be raised about both of these steps — since I believe that it is the first step that is interestingly invalid, I will discuss them in reverse order, second step first.

The second step: McTaggart's move from 52* and 53* to $52'$ and $53'$ is something we have met before. It is the same inference that played a role in the problem of intrinsic change for A-properties. Here, as before, an inference is being made from a time-indexed predication (50, 51, 52*, or 53*) to an index-free predication ($50'$, $51'$, $52'$, or $53'$).

One might doubt the validity of this inference on the grounds that it leads to the problem of intrinsic change. However, as I showed above, a standard solution to the problem of intrinsic change can be construed as *accepting* the validity of the inference from 50 and 51 to $50'$ and $51'$. The solution consisted, not in denying the validity of this inference, but in exposing an equivocation

between a reading of 50′ and 51′ which makes them an inconsistent pair, and one which makes them compatible.

By contrast, because of the word "wholly" in 52∗, 53∗, 52′, and 53′, this equivocation is not present in those sentences. Each pair is, therefore, unambiguously inconsistent — McTaggart's second step seems valid.

The first step: The first step in McTaggart's argument is the application of the analysis of tense described above to 52 and 53, which produces the tenseless sentences 52∗ and 53∗. This is a point at which many A-theorists reject McTaggart's reasoning by holding that tense is unanalysable.

The unanalysability of tense, is, however, no part of the A-theory itself. An A-theorist can analyse tense if she wishes, not in McTaggart's way, but in terms of the tenseless counterfactual conditionals I mentioned earlier[4] which the A-theory can distinctively make sense of:

> X will be Y iff
>> there is some future time t_f such that were it t_f, X would be Y

> X is-now Y iff
>> there is some present time t_n such that were it t_n, X would be Y

> X was Y iff
>> there is some past time t_p such that were it t_p, X would be Y

Since the counterfactual corresponding to "X is-now Y" has a true antecedent, it can be simplified to

> X is-now Y iff
>> X is Y

Let us call this the Counterfactual Theory of Tense. Given the Counterfactual Theory, it does not follow from the fact that certain things will be past that they are past at any time — or from the fact that certain things were future that they are future at any time. An A-theorist ought to analyse 52 and 53 as

> **52$_c$** There is some past time such that, were it that time, M would be wholly future.

53$_c$ There is some future time such that, were it that time, M would be wholly past.

From these, needless to say, 52′ and 53′ do not follow. For familiar reasons, these counterfactuals can be non-trivially true without M itself being wholly past or wholly future at any time. Indeed, M might be an instantaneous event taking place wholly in the present, and 52$_c$ and 53$_c$ could still be true.

If my reconstruction of McTaggart's argument is correct, then it does not produce a contradiction from the A-theory alone, but only in conjunction with McTaggart's analysis of tense, which the contradiction itself gives any A-theorist good reason to reject.

E.2.3   Passage and the A-theory

If what I have said so far in this section has been correct, the A-theory can be defended from the traditional McTaggart-inspired objections if the Counterfactual Theory of Tense can be. But there is yet a third way of reading McTaggart, which can be used as an objection to the Counterfactual Theory. The objection will be that the Counterfactual Theory cannot make sense of time's passage. Moreover, it can be claimed that it is exactly time's passage that McTaggart is appealing to with the quote mentioned above:[5]

> If M is past, it has been present and future. If it is future, it will be present and past. If it is present, it has been future and will be past. (MCTAGGART 1927, s. 329)

According to the Counterfactual Theory, the truths expressed by the sentences above don't imply any change in the kind of rich dynamic sense that has been held to be required for the passage of time. They merely express modal truths about other possible worlds, where the distribution of A-properties is different to the way it actually is.

52$_c$ and 53$_c$ do not imply that M changes as regards its A-properties, any more than the counterfactual, "If my poker were hot at t_2, I would burn myself" implies a change in the poker. The objection is that we need something more like McTaggart's analysis of tense to capture the rich and dynamic passage of time expressed by 52 and 53.

The answer to this twofold. First, it's not clear to me that believing in the Counterfactual Theory of Tense rules out believing in the passage of time. If the Counterfactual Theory is true, then it seems that the mere truth of "Whatever is future, will be present" doesn't entail that time passes in an appropriately rich and dynamic sense. But it doesn't follow that, if the Counterfactual Theory is true, then time doesn't pass. So, if you are attached to the passage of time, that's not in itself a reason to deny the Counterfactual Theory.

Second, an A-theorist isn't, *qua* A-theorist, committed to passage. The A-theory just says that there are A-properties. Whether time passes is a further question. There are some arguments, apparently independent of McTaggart's argument, to the conclusion that it doesn't: the regress of temporal dimensions discussed by J.J.C Smart (1963, p. 136) and D.C. Williams (1966, p. 296) for example.[6] If these arguments, or McTaggart's Paradox construed as an argument against the passage of time, are sound, then so much the worse for passage. Our reasons for believing the A-theory, as described in section E.1.2, remain. It is possible to believe in the A-theory without believing in passage — if there are decisive objections to passage, then that's what someone who takes these reasons seriously should believe. If we reject passage, it can't be an objection to the Counterfactual Theory that the reading it gives of "Whatever is future, will be present" does not entail that time passes.

For the purposes of this paper, I want to remain neutral about whether time passes.

E.3   Realism, Indexicalism and the A-theory

The conclusions of the previous sections have been mainly negative. We have seen how to define the A-theory in such a way that it is distinct from any claim about the analysis of tense or the passage of time, and seen how to resist various readings of, or arguments inspired by, McTaggart's Paradox. I now aim to do something more constructive. It seems to me that the A-theory can be used to argue for some positions in philosophy of time that are distinct from it: realism about the past and future, and what may be loosely called "indexicalism": the view that there is an indexical element in tense.

While these positions are not commonly held by A-theorists, we must bear in mind what I said earlier (section E.1.1) about the dangers of conflating the A-theory with other doctrines that might happen to be held by people

who believe the A-theory. The comprehensive theory of time I am defending is an A-theory, for all that it accepts many of the trappings associated with the B-theory.

The argument for this comprehensive theory of time is broken into four sections: first, I argue for realism about the past and future in general terms, independent of the A-theory (section E.3.1). Then, I consider an argument which shows that the combination of realism about the past and future with the A-theory leads to implausible results unless there is an indexical element in tense (section E.3.2); finally, I argue that the A-theorist has specific reasons to accept realism about the past and future (section E.3.3), and reply to a final objection (section E.3.4).

E.3.1   General Arguments for Realism

By "realism about the past and future", I mean metaphysical realism — the thesis that a certain domain of entities, past and future entities in this case, exist and are mind-independent. (Devitt 1984, pp. 11–21) I don't mean semantic realism — the thesis that certain kinds of sentences, which would in this case be past and future tense sentences, are truth-apt.

The distinction is important here, because theories of time which accept semantic realism about the past and future, but deny metaphysical realism about the past, and especially the future, are commonplace, and often associated with the A-theory. Even my own proposal could be understood in this light: the Counterfactual Theory might suggest a way to assign truth values to past and future tensed sentences without requiring that there actually be any past and future events. Julius Caesar doesn't have to exist for "Were it 50 BCE, Caesar would be bald" to be truth-apt, and that counterfactual is all that we are asserting, according to the Counterfactual Theory, when we say "Julius Caesar was bald in 50 BCE".

In the form I have presented it, the Counterfactual Theory quantifies over past and future times, which is perhaps contrary to metaphysical anti-realism about the past and future. It would not take too much work, however, to remove this commitment — perhaps by making the quantification substitutional or possibilist; perhaps by redescribing the anti-realist position so that it is compatible with there being past or future times, provided nothing exists at these times. In any case, as I will argue in section E.3.3, there is a more substantive argument from the Counterfactual Theory to metaphysical realism about the past and future.

Semantic realism about the past and future seems to me to be an unexcitingly true doctrine.[7] Or, at any rate, given the Counterfactual Theory, whatever arguments there are to be had about it are instances of arguments about the correct semantics of counterfactuals, which goes far beyond the scope of this paper. So, henceforth, I will use "realism" to mean metaphysical realism.

Realism about the past ought to appeal to anyone who is not an anti-realist across the board. We know that past objects exist for the same reason we know extra-mental objects exist. We've seen them! Perceptual processes take time: it follows that if we are perceiving in the present (or even a little bit into the future) then we are perceiving things that happened some time ago, in the past. Look into the night sky, and you see can see events transpiring millions of years into the past. Realism about the past thus seems to be part and parcel of realism about the common-sense entities that we take ourselves to be observing.

Past entities are also indispensible in causal explanation, since, again, causal processes take time. So even unobserved past objects have an important role to play in explaining present phenomena, implicating realism about the past in scientific, as well as common sense, realism.

Anti-realists about the past sometimes claim that causation can be reconstructed as a relation that holds between contemporaries. "At any given time the causal relation holds between properties... each of which is present and is presently instantiated. These properties may include things like the property of being burdened with a certain sort of past, or (as Leibniz put it) pregnant with a certain sort of future." (BIGELOW 1996, p. 47) The cause of, for example, a match's now having the property *being alight* might be regarded as the match's now having the property *having been struck*.

This latter property has to be understood in a way that makes a match's having it compatible with the non-existence of the past. I am not sure that there is any such way; but supposing that there is, my point still stands. An anti-realist about the past may be able to give *a* causal explanation of the match's being alight, but cannot give the causal explanation we do give in our scientific and ordinary practice, in terms of a past striking of the match (or in terms of any past event).

Realism about the future is a little harder to defend, at least for an A-theorist. A usual argument is that given realism about the past, to posit such an intrinsic difference between past and future as would be required to be a realist about the past but not the future would be anthropocentric. This argument is not available to an A-theorist, who must hold that intrinsic

differences between past and future are either not anthropocentric or not objectionably so.

There are other arguments, though, analogous to those for the existence of the past. Our ability to act in the future is analogous to our ability to perceive the past. Action, like perception, takes time, so insofar as we know that we are capable of influencing external objects by means of acting, we know that there are future objects, because it is those that we influence.

In addition, if there were no future, it would tend to undercut our confidence in causal explanation. If, sometimes, striking a match (in appropriate circumstances) was insufficient to cause a subsequent flame, we would be unsatisfied with citing the striking of past matches as a causal explanation of past or present flames. But, inevitably, if there is no future, there will be failures of causal sufficiency for every cause whose effect would take place in the future.

Finally, if, as may be the case, backwards causation is needed for the causal explanation of certain processes described by quantum mechanics (PRICE 1996), future entities will be as obviously causally indispensible as past ones.

E.3.2   The Epistemic Argument for Indexicalism

There is an argument which purports to show that an A-theory of the kind I have defended must reject realism about the past and future. According to realism about the past, Julius Caesar exists; and according the A-theory, he's intrinsically wholly past. So the following proposition is true:

> **54** Julius Caesar is (wholly) past.

If realism about the past is true, and the A-theory is true, so too is 54. But implausible results flow from 54: Caesar, it would seem, is the subject of a hideous metaphysical delusion — he believes that he is present, but yet he is past. Moreover, present people are in no better epistemic position than he is. What makes us think that we are the lucky ones who are right in our belief that we are present? If, by chance, we were, we could hardly be justified in our luckily true belief.[8]

Think about what a non-A-theorist would say about 54. Not that it is false! 54 is surely true, if any statement to the effect that something is wholly

past can be true. What generates the problem is Caesar's thought that he is present, which seems to be true and incompatible with 54. Actually, we can shortcut the question of whether it really is incompatible by imagining that Caesar entertains 54 itself. If he did, he must have rejected it immediately; and rightly so. What seems to be the problem with 54 is that it is true in our mouths, and false in Caesar's.

The B-theorists have a ready diagnosis of the changing truth value of 54 — they can say that it contains a hidden indexical element. Being past, perhaps, is just a matter of being earlier than a certain indexically denoted time — to say "Caesar is past" is to say "Caesar is earlier than *this* time". Such an analysis of "is past" is incompatible with the A-theory, however, since being earlier than a certain time is not an intrinsic property.

There is no reason, however, that an A-theorist cannot avail herself of an indexical element in the semantics of "is past", provided she continues to hold that things are past in virtue of having an intrinsic, monadic property of pastness. Recall that there are many, many different A-properties (at least one for each time) corresponding to the many different degrees of pastness and futurity. The A-theorist should hold that which determinate A-property we denote by the word "presentness" and express by the predicate "is present" depends, indexically, on the time of utterance.

Thus, Caesar, uttering the sentence "Caesar is present" (or its equivalent in Latin), expresses an A-property he actually has; while when we utter that sentence, we express an A-property he does not have. Similarly for 54, except that pastness is a large disjunction of determinate A-properties, rather than a determinate A-property itself.

My proposal that the predicates which express A-properties should be regarded as indexical will no doubt meet with objections. We must remind ourselves again of the danger of conflating the A-theory with other doctrines widely believed by A-theorists (discussed in section E.1.1). That "past", "present" and "future" are covertly indexical is almost uniformly denied by traditional A-theorists (I know of one exception, E.J. Lowe[9]) — but this does not make it incompatible with the A-theory.

It may be thought that this proposal deprives the A-properties of any real metaphysical role; or makes them mere haecceities of times (the property each time has in virtue of being *that* time). On the contrary, the A-properties have a very important role to play in explaining what it is for it to be a certain time at a world. It is precisely because times other than the present could have lacked the degree of pastness or futurity they actually have (while they

could not fail to have their own haecceities) that it makes sense to say "it might have been 50 BCE" and to speculate about what would have been the case were it 50 BCE.

E.3.3   The Groundedness Argument for Realism

I have argued that the A-theory is compatible with realism about the past and future. Not only is it compatible, though: I will now argue that an A-theorist positively *ought* to believe in the past and future.

Roughly speaking, my complaint against anti-realism about the past and future is that it cannot furnish grounds or truthmakers for past and future tense truths. This is a common complaint. Put this way, however, it is unclear just what is being asked of the anti-realist. What is it for a truth to have a ground or a truthmaker? Why should we think that past and future tensed truths need them? It is open to anti-realists to simply deny that truths require truthmakers.[10] The Counterfactual Theory of Tense, however, gives us a way to shortcut that problem, by putting the complaint about groundedness in a way that does not involve appeal to any contentious truthmaker principle.

The first step in this argument is from the A-theory proper to the Counterfactual Theory of Tense, as described in section E.2.2. This move is not deductive, as the Counterfactual Theory is only one among many theories of tense, and is not entailed by the A-theory. It seems, however, to provide the best explanation of tense against an A-theoretic background, so there is at least an abductive inference from the A-theory to the Counterfactual Theory.

According to the Counterfactual Theory, many ordinary truths about the past or future (such as 55, below) should be analysed as counterfactual conditionals (such as 55_c):

   55 Julius Caesar was bald.

 55_c There is some past time such that, were it that time, Julius Caesar would be bald.

The truth of such a counterfactual itself calls for explanation. On the standard semantics, what 55_c says is that there is some past time, 50 BCE, say,

such that, in all the nearest (ie. the most similar) to actuality possible worlds where 50 BCE is present, Caesar is bald. Let us call worlds where 50 BCE is present and Caesar is bald, Caesar worlds. What needs to be explained is the close similarity between the Caesar worlds and the actual world. This similarity, I think, can only consist in the existence of a counterpart of the actual present at the Caesar worlds, and of a counterpart of the Caesar worlds' presents in the actual world.

Suppose that there are a mixture of presentist worlds (worlds that are wholly present), and realist worlds (worlds with a past and future) in the cosmos. If the actual world is a presentist world, then a presentist Caesar world has very little in common with it. In fact, the only thing it has in common is the A-property of presentness. If there is a presentist world where 50 BCE is present, and Caesar is hirsute — a hirsute world — there seems to be no reason for that world not to be at least as similar to the actual world as any Caesar world. But then 55_c would be false, which it is not.

In any case, there will be worlds much more similar to the actual world than either a presentist Caesar world or a hirsute variant on it. A non-presentist Caesar world containing a future counterpart of the actual present will have more in common with the actual world than a presentist Caesar world — it contains a part qualitatively identical to the actual present, except for its A-properties. We should, therefore, regard the closest worlds where the antecedent of 55_c is true as non-presentist worlds, furnished with a real past and future.

The actual world must also be a non-presentist world. If the actual world is a presentist world, there will still be nothing to choose between a non-presentist Caesar world, and a non-presentist hirsute world. Both have exactly the same features in common with the actual world; namely, their respective counterparts of what is actually the present. The only thing that can make a Caesar world more qualitatively similar to the actual world than a hirsute world is if the actual world contains an actual Caesar who is actually bald.

An actual past Caesar is required to ground the truth of 55_c, and similar arguments apply, *mutatis mutandis*, to enough similar counterfactuals to require the existence of an entire past and future for the actual world.

E.3.4   Tensed Properties

According to the Counterfactual Theory of Tense, when we say that Caesar was bald, we assert a certain counterfactual conditional, which, I have suggested, should be analysed by means of the usual possible worlds semantics. It may be objected, though, that this makes sentences like 55 into sentences not about the actual Caesar, but some other-worldly Caesar counterpart; or at best, not about the actual world but some other world also containing Caesar.

Insofar as this objection speaks against the semantics for counterfactual conditionals, rather than against my proposal to analyse tense by means of counterfactuals, a reply to it would be beyond the scope of this paper. I do however have a reply for the objector who finds this problem especially difficult in the case of tense.

If it makes it easier, we can think of 55 as ascribing a property of *having been bald* to Caesar (our, actual, Caesar). This property is a "tensed property"; Caesar has it iff the tensed sentence "He was bald" is true of him. We have met tensed properties before, in the context of my disccusion of the anti-realist idea that the causal realtion holds only between contemporaries (section E.3.1) — there the example was *having been struck*. Tensed properties are often thought to be mysterious, but the Counterfactual Theory shows how to assimilate them to something quite familiar.

A thing has the property of fragility iff, were it struck in a suitable way, it would break; it has the property of solubility iff, were it placed in a suitable solvent, it would dissolve. Similarly, a thing has the property of having been bald iff, were a suitable time present, it would be bald. Tensed properties are dispositional properties according to the Counterfactual Theory. Just as the solubility of a sample of sugar has a categorial basis in the sugar's molecular structure, Caesar's having been bald has a categorial basis in Caesar's actually being bald at some past time (as I argued in section E.3.3).

Just as Caesar may never find himself in the appropriate circumstances to manifest his disposition to be bald (i.e. never find himself at a present time) in the actual world, so a sample of sugar may never find itself in appropriate circumstances to manifest its disposition to dissolve (i.e. never find itself in a suitable solvent). But it should not follow that "Caesar was bald" is not about Caesar, any more than "This sugar is soluble" is not about this sugar.

E.4   The Status of the Theory

If all that I have said is correct, there is a coherent comprehensive theory of time that combines the A-theory with indexicalism and with realism about the past and future. I have argued for the conditional conclusion that, if the A-theory is true, then we ought to believe this comprehensive theory. The comprehensive theory is not, however, part of the A-theory, nor is it entailed by it. Crucial steps in the argument were abductive: the Counterfactual Theory appears to be the best explanation of tense available to the A-theorist; realism the best explanation of the truth of the counterfactual conditionals required by the Counterfactual Theory. Indexicalism was needed to explain the changing truth value of "Caesar is past".

The conditional conclusion we have reached cannot tell us the status of this comprehensive theory. All that we can say is that it is at least as plausible as the A-theory itself. As I have mentioned, I am a B-theorist — I deny the antecedent of the conditional conclusion, and thus have no reason to believe the comprehensive theory I have been arguing for.

But the appeal of the A-theory has never been as a matter of naturalistically minded speculative metaphysics. It is not as if A-theorists have ever imagined that physicists will sometime come to acknowledge A-properties together with charge, rest mass, and spin among the fundamental properties of things in time. Indeed, it looks as though relativistic physics has already falsified the A-theory, as it is hard to make the A-theory compatible with the relativity of simultaneity.[11]

A-theorists have always appealed to the A-theory as a matter of descriptive metaphysics, conceptual analysis, or phenomenology; and here I think it is quite plausible, provided we do not imagine that what is implicit in some aspects of ordinary language, folk theory, or phenomenological feel is an infallible guide to the nature of the universe.

In particular, I think that the idea that what time it is is an ordinary fact about the world, as discussed in section E.1.2, provides some support for the A-theory, construed in this way. The passage of time is associated with this idea. Since passage is independently problematic (see section E.2.3), this cannot directly lend any support to the A-theory. However, contingency is the next best thing to change — the Counterfactual Theory of Tense shows how to accomodate the intuition that future times will be present, and that this reflects a difference in an ordinary matter of fact.

I have not tried very hard here to argue for the intuitions that support the A-theory. The literature is already very full of such arguments, in any case. My suggestion is that, insofar as such arguments are compelling, they may be taken to support an A-theory of time which is not so very far from what the B-theorists believe already.[12]

Notes

[1]McTaggart explicitly allows that the A-properties could be relational. (MCTAGGART 1927, s. 326) His reasons are, however, obscure, and no A-theorist has followed him in holding that A-properties consist in being related to some object outside of time, so we may safely ignore this option.

[2]For a more detailed response to Williams along similar lines, see Nunn (2000).

[3]I don't mean to claim that temporal parts are the only way to solve the problem of intrinsic change, or even the best way. All that I am going to say in the language of temporal parts, however, can be translated into the language of distributional properties (PARSONS 2000) which does not presuppose the existence of temporal parts. I have used temporal part talk here because it will be more familiar to most readers.

[4]This suggestion is similar to Bigelow's (BIGELOW 1991), except that he analyses tense directly in terms of the possible worlds semantics, without mentioning the counterfactuals. My way of putting it has the advantage of not appearing *ad hoc* — it is the very distinctive advantage of the A-theory that it can make sense of these counterfactuals with *seem* sensible in ordinary usage.

[5]Thus, for example, D.H. Mellor paraphrases this passage of McTaggart as "Past, present and future tenses are mutually incompatible... But *because they are forever changing* everything has to have them all." (MELLOR 1993, p. 51) (my emphasis)

[6]For a defense of passage against these arguments, see Markosian (1993).

[7]For a dissenting view, see Dummett (1969).

[8]Compare David Lewis's argument against the absolute theory of actuality: "What a remarkable bit of luck for us if the very world we are part of is the one that is absolutely actual... What reason could we ever have to think it was so? How could we ever know?" (LEWIS 1986, p. 93)

[9]Lowe writes: "it is helpful to accentuate a feature of A-series expressions... namely, their indexicality... '*e* is present' means, of course, '*e* is happening *now*', and 'now' may usefully be compared with other indexical expressions like 'here' and 'I'." (LOWE 1987A, p. 65)

[10]Nor would this be totally *ad hoc*. Even those who take truthmakers very seriously have trouble finding enough to make true totality truths, such as "Those are all the ravens

there are" — or worse, "Those are all the truthmakers there are." For one discussion of this problem, and a sample solution, see (ARMSTRONG 1997, pp. 196–201).

[11] Hilary Putnam gives an argument for the B-theory from the relativity of simultaneity in (PUTNAM 1967). Though Putnam's argument is directed against the view that only the present is real, it will also work against the view that only the present has the A-property of presentness. For a bold attempt to answer this line of argument, see Tooley (1997, ch. 11).

[12] I am grateful for comments on this paper from Heather Dyke, John Heil, Nathan Oaklander, Denis Robinson, and the participants at the *Time and Ethics 2001* conference at Otago University.

Appendix F

Distributional Properties

Unpublished paper entitled "Distributional Properties"

In metaphysical discussions of properties, people use examples such as the properties of *being red*, *being 1kg in mass* and so on. But these are not the sorts of properties had by the ordinary objects of our acquaintance. For example, what does it take for a tomato to have the property of *being red*. Must it be red all over? Or just mostly red? Or even red at some point on its surface? This question seems hard to answer.

In this paper I try to explain and solve the puzzle that is implicit in this question. The splution, as it seems to me, concerns a type of property that I call "distributional" (section F.1). Some distributional properties have an important and interesting feature: uniformity (section F.3). Finally, this feature lends us some help in understanding change (section F.4).

F.1   A puzzle about determinables

Can an object be coloured without having a colour? Surely not. But what about the surface of a chessboard? Or the surface of a painting or photograph? These things don't have a particular colour. But they are coloured.

The parts of chessboards and paintings have colours. Each square of a chessboard has a colour and each brushstroke of a painting has a determinate colour. There is no problem about the squares and brushstrokes being

coloured. But a chessboard is not a single square, and most paintings are not single brushstrokes. Even if every part of every chessboard or every painting has a colour, the puzzle that chessboards and paintings are coloured without *themselves* having colours does not go away.

Let's put the puzzle in a more theoretical framework: *being coloured* is what is often called a **determinable** property. Every determinable property comes with a set of **determinate** properties. To have the determinable is simply to have one of the determinate properties from that set. In the case of *being coloured*, the determinates are normally thought to be *being red*, *being mauve*, *being fuchsia*, and so on, corresponding to each of the colours.

What the puzzle about chessboards and paintings shows is that, in a world of spatially extended objects, things are not nearly so simple. It looks as though either *being coloured* is not a determinable property after all, or its set of determinates is larger than we thought.

If we want to continue to make sense of the determinable / determinate distinction, I think we should choose the second option. The determinate properties belonging to the determinable *being coloured* includes not only the properties of being uniformly red, mauve, fuchsia, and so on, but also the all the properties of having such and such a colour distribution: *being checked*, *being polka dotted* and so on.

Two comments about this:

1) *Being checked* is itself a determinable property. Among its determinates is, for example, *having 5 cm red and black checks*. This is nothing new: *being red* is also determinable, among its determinates being *being scarlet* and *being crimson*.

2) I am assuming that *being red* is the same property as *being uniformly red*. Perhaps this is not the case — perhaps *being red* is a property only a point-like object could have. In that case, since it is usually thought that microscopic objects are too small to be coloured, nothing would be red, which seems odd.

To put point 2 another way, I am assuming that colours are a kind of colour distribution, namely, the uniform colour distributions. If this is right, then the determinates that belong to *being coloured* are all colour distributions. To be coloured is not to have a colour, but to have a colour distribution.

Of course, there is nothing special about the role of colour in all this. We can intelligbly talk about mass distributions, charge distributions, saltiness

distributions. If you don't find this talk intelligible, there's not much more that I can do except point out that it makes sense to me, and it solves the puzzle about chessboards and paintings. I call the properties *having such-and-such mass distribution*, *having such-and-such a colour distribution*, *being polka-dotted*, *being uniformly red*, and all their their ilk **distributional properties**.[1]

F.2 Analysis

Some people find it very natural to analyse distributional properties in terms of the parts of objects that have the distributional properties, the spatial relations between those parts, and the properties of those parts. For example, some will say that to have 5 cm red and black checks is just to have a number of square parts, each 5 cm across, some red, and others black, arranged in space in a certain kind of way.

I think that to attempt an *analysis* of distributional properties in this way is a mistake. One reason is that, if I am right that colours are themselves colour distributions, then being red and being black are themselves colour distributions, so the proposed analysis does not in fact analyse distributional properties in terms of something else.

Another is that it seems to me to be conceptually possible that objects should be multiply located in time and space. Looking at a chessboard, I see that it has a certain kind of colour distribution, but I don't see that it has certain kinds of parts. To see that, I have to look much closer at the chessboard, to determine what type of material it's made out of. An other-worldly chessboard might be made out of special Aristotelean matter that fills up space without having any proper parts. Of course, one way to have the colour

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[1]Some other authors have come close to the concept of distributional property that I intend to use here. Grelling and Oppenheim's "Gestalt qualities" (SIMONS 1987, pp. 354–360) are similar, except that the concept of a Gestalt carries with it a lot of psychological and epistemological baggage that I want to avoid. Also Gestalt qualities are supposed to be had only by complex objects, whereas I think that a simple object's having a distributional property is an important conceptual possibility (see section F.2). Another closely related concept is that of a "structural property", much discussed in Australian metaphysics (ARMSTRONG 1997, pp. 34–38). Structural properties are, however, again only had by complex objects — by objects with structure — and the canonical examples are had by objects with a discrete structure, such as a methane molecule. It is hard to see how to apply structural properties to solve the problem of determinables discussed in section F.1.

distribution that chessboards usually do is to have certain kinds of parts arranged in a certain kind of way; but that is only a sufficient condition for having the colour distribution, not a necessary one.

Even if you don't agree with me here, another seeming conceptual possibility is also incompatible with the analysability of distributional properties. It seems to be conceptually possible that things be made out of an indefinitely divisible, atomless material sometimes called "gunk" (LEWIS 1991, p. 20). Gunky objects have no unextended parts. If a gunky object has a distributional property, then, while this can be explained in terms of the parts of the object, these parts will always be extended, and so their properties will always be just more distributional properties.

This problem is particularly vivid if you imagine a piece of gunk the colour distribution of which is a continuous spectrum, like a rainbow. It's true that the colour distribution of such an object would supervene on the properties and spatial relations of its parts — but the properties in question will always be continuous, non-uniform, colour distributions, just like the one you are trying to analyse.

Instead of analysing distributional properties in terms of properties of the parts of objects, we might try to analyse them in terms of properties of the regions of space those objects occupy. For example, you might say that for an object x to have 5 cm red and black checks is to for x to occupy a number of square regions of space, each 5 cm across, some of which regions the object is red at, some of which it is black at, and for those regions to be arranged in a certain kind of way.

This proposal would be compatible with there being checkered objects made out of Aristotelean stuff or atomless gunk. However, there is another problem here. It seems possible that some distributional properties should be intrinsic. But if they are analysed in terms of relations such as red-at and black-at which objects bear to places, they would appear to be extrinsic.

I don't want to make a big deal out of these objections here, as I think it is interesting enough to explore the consequences of taking distributional properties to be unanalysable, regardless of how well my reasons for thinking so stand up.

F.3   Uniformity

Some distributional properties are uniform and others are not. The colour
distribution of the surface of a ripe tomato is uniform; the colour distribution
of the surface of a chessboard is not. We can also describe objects as being
uniform with regard to certain determinables. The surface of a ripe tomato
is uniform with regard to colour; the surface of a chessboard is not.

We might try to define uniformity this way: an object x is uniformly ϕ, iff, for
some determinate ψ belonging to ϕ, for all regions of space s that x occupies,
x is ψ at s.

This won't work unless we restrict ψ, however. Suppose that we want to
decide whether an object coloured in garish stripes of blue and green is uni-
formly coloured using this definition. If ψ is allowed to be the distributional
property of *having blue and green stripes*, then this object will count as uni-
form. If my argument of section F.1 was correct, then *having blue and green
stripes* is as respectable a determinate of *being coloured* as *being blue all over*
is. We need some other reason to discount it; and it's hard to imagine what
reason we could have that wouldn't beg the question.

This problem is analogous to a well studied problem about resemblance. We
might try to say that an object x resembles an object y with regard to ϕ iff
for some determinate ψ belonging to ϕ, x is ψ and y is ψ. Do a blue sapphire
and a green emerald resemble one another with regard to colour? If ψ is
allowed to be the property of *being blue or green*, yes. For the sapphire is
blue or green, and the emerald is blue or green.

I don't want to try to solve this old problem in a new way, just to suggest
that we should treat the problem about defining uniformity similarly. If we
want to believe that there is objective resemblance in the world, we will need
to hold that there is an objective distinction between those properties that
"make for resemblance" (such as *being blue*) and those that do not (such as
being blue or green). Just so, if we want to believe that there is objective
uniformity in the world, we will need to hold that there is an objective
distinction between those properties that can be a respect in which an object
is uniform (such as *being blue all over*) and those that cannot (such as *having
blue and green stripes*).

Here is where people who wanted to analyse distributional properties of ob-
jects in terms of the properties and spatial arrangement of the parts of those
objects will object again. If we could analyse distributional properties that

way, then we could also analyse uniformity. We could say that an object is uniform with regard to ϕ iff all its parts resemble each other with regard to ϕ. I won't go over my reasons for rejecting the analysis of distributional properties again here. I acknowledge, though, that there is something to this objections. Uniformity and resemblance to seem to be closely allied concepts, and an analysis of one in terms of the other is attractive.

There is a connection to be found, even if we reject the analysis of distributional properties. Given the resources of classical mereology (SIMONS 1987, p. 37), we can say that an object x resembles another y with regard to some uniform respect ϕ iff the mereological sum of x and y is uniform with regard to ϕ. This falls a little short of an analysis, because it doesn't have anything to say about what makes two object resemble each other with regard to a non-uniform distributional property.

F.4   Change

Change is simply the temporal analogue of non-uniformity. This view is dependent on a substantive assumption in the philosophy of time: I am assuming that time is, more or less, like space. I won't argue for this assumption here. But if we accept it, then the relationship between change and uniformity is just one more that we can add to a long list of analogies between space and time. (TAYLOR 1992, p. 69)

Just as the surface of a chessboard can have a non-uniform colour distribution over space (being red here, and black there) an object that changes its colour has a non-uniform colour distribution over time (being red then, and black now). Think of, for example, a red ripe tomato sitting in the sun for some days, drying up, and turning black.

If we think of duration on the model of extension, we should think of the change the tomato undergoes, from being red to being black, on the model of a non-uniform colour distribution. It's just as if the tomato were red at one end, and black at the other — except that the ends in question are times, not places.

Just as uniformity is a concept that can be applied either to distributional properties or to the objects that have those properties, so too is change. The colour distribution of the tomato in my example is a changing one (that is to say, a temporally non-uniform one). The tomato itself is a changing thing because it has a changing property: its colour distribution.

The theory of change I have just described is an eternalist theory of change: I am thinking of objects as being four-dimensional objects extended in time, much as they are extended in space, existing tenselessly, and so on. But it is not the usual eternalist theory, according to which objects change iff they have temporal parts, or "time slices" with incompatible properties.[2]

The temporal parts theory of change would coincide with the distributional properties theory if the analysis of section F.2 of distributional properties in terms of the parts of the object that has the distributional property were correct. However, if that analysis is to be rejected, then the distributional properties theory is an important new account of change which is compatible with endurantism (the doctrine that persisting objects are multiple times *without* having temporal parts).

There is an important objection to this theory of change. Allegedly, the theory I have just described *eliminates* change, rather than analysing it. Consider the tomato changing colour. To say that it changes is to say that it has a certain kind of colour distribution — one that is non-uniform over time. But the tomato has that colour distribution eternally. Therefore, it does not change with regard to it. The distributional properties theory of change "trade[s] in the changing temporary properties for the permanent intrinsic property of having such-and-such history of change." (LEWIS 2001)

This objection, however, is assuming something quite foreign to the distributional properties analysis — namely that to change with regard to a property is a way of having that property, which is to be contrasted with having that property permanently, or eternally. According to this assumption, "permanently" and "temporarily" are like adverbial modifiers. When you say that a tomato is temporarily red, you say something about the relationship between the tomato and redness; when you say that the tomato is permanently red you say something different (and incompatible) about the relationship between that very object and that very property.

According to the distributional properties view, the distinction between changing and being changeless with regard to a property is not a distinction between two ways of having that property. Rather it's a distinction between two kinds of properties: the changing ones and the non-changing ones; and a parallel distinction between two kinds of things, those that have a changing

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[2]A classic statement of this view from J.J.C Smart: "[I]nstead of talking of things or processes changing or not changing we can now talk of one time slice of a four-dimensional entity *being* different or not different from some other time slice." (SMART 1963, p. 133) For a more contemporary statement, see (HELLER 1992), especially section 2.

property, and those that don't. When you say that a tomato is permanently red, you say that it has one property; when you say that it is temporarily red, you say that it has a different (and incompatible) property.

The property of being temporarily (or changingly) red is one property, and the property of being permanently (or changelessly) red is another. You can't have the first property permanently, or the second temporarily. It doesn't follow from the fact that an object has a property eternally that that property is not a changing one.

Perhaps this point can be made clearer by showing how an analogous objection would fail in the spatial case. The objection would go like this: to say that a chessboard is non-uniform in colour is to say that it has a certain kind of colour distribution — one that is non-uniform over space. But the chessboard has that colour distribution, as it were, at every point at which it is located. Therefore, the chessboard is uniform with regard to the colour distribution. The distributional properties account of non-uniformity trades in having colours non-uniformly for uniformly having such-and-such a colour distribution. It has eliminated non-uniformity.

Of course this objection fails because it does not follow from the colour distribution's being had by the chessboard at every point that that colour distribution is a uniform one. Checkered colour distributions are essentially non-uniform — there is no way to have them uniformly.

F.5   Conclusion

If all I have said so far is correct, then a little reflection on the properties of ordinary spatially extended objects produces a surprisingly interesting new field of investigation in the metaphysics of properties. The insights thereby acquired also help us understand change.

I don't pretend to have done more than scratch the surface of the phenomena related to distributional properties, uniformity and non-uniformity. These are clearly, however, powerful concepts — it would be interesting to see them put to work in areas other than those I have touched on here.

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