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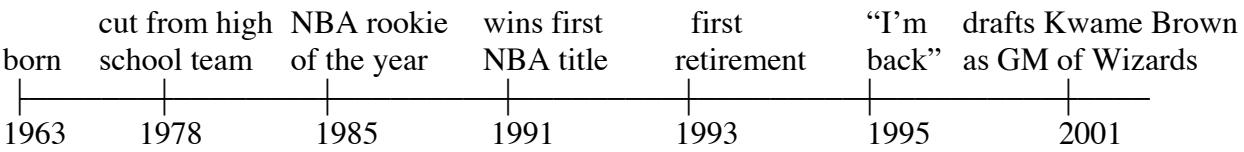
Temporal Parts[1]

1. What are temporal parts?

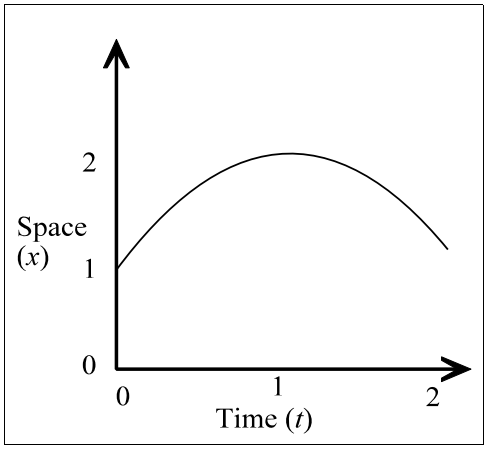
I will argue that temporal parts theory is true, but first we need to get clear on what exactly this theory says. Let's start with the idea that *time is like space*.

Everyone has seen timelines, in magazines and encyclopedias:

Michael Jordan's life



For some reason, time is easier to comprehend when represented by a spatial diagram. A timeline is such a diagram. The spatial line on this page represents a stretch of time — Jordan's life.



Diagrams of motion from high school physics take this a step further, by representing one dimension of space in addition to time. The diagram on the right represents a moving particle. The horizontal axis represents time; the vertical axis, space. Since the diagram contains only a single spatial axis, it can represent only one spatial dimension of the particle's motion (motion in the *x* direction). The curved line on the diagram represents the motion of the particle, which begins at spatial location $x=1$ at time $t=0$, moves to location $x=2$ by time $t=1$, then moves back to location $x=1$ by time $t=2$.

Spacetime diagrams take this a step further, by representing more spatial dimensions alongside time. The spacetime diagram below includes two spatial dimensions in its depiction of a dinosaur from the Jurassic period and a person born in 2000 A.D.

All these diagrams represent time as just another dimension, alongside the spatial dimensions. Given how convenient this method of representation is, many philosophers and scientists have wondered whether time itself is in some sense just another dimension. The question amounts to whether, and to what extent, time is like space.

Temporal parts theory is the claim that time is like space in one particular respect, namely, with respect to *parts*. First think about parts in space. A spatially extended object such

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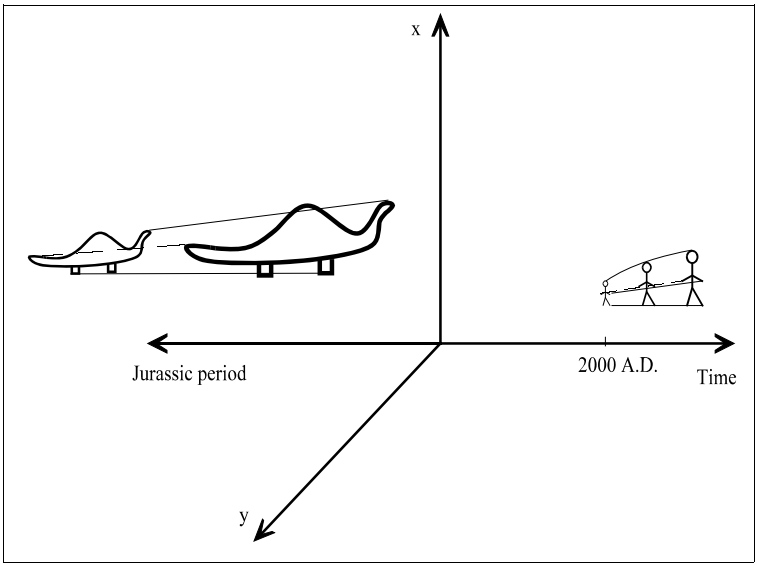
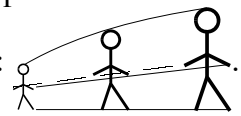
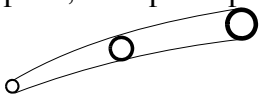
[1] Parts of this chapter are based on chapter 3 of Conee and Sider 2005. Thanks to Cian Dorr for the idea of introducing spacetime diagrams with timelines, and to Eliza Block, John Hawthorne, Irem Kurtsal Steen, and Dean Zimmerman for helpful comments.



Space-Time Diagram

as a person has *spatial parts*: her head, arms, etc. Likewise, according to temporal parts theory, a temporally extended object has *temporal parts*. Following the analogy, since spatial parts are smaller than the whole object in spatial dimensions, temporal parts are smaller than the whole object in the temporal dimension. They are shorter-lived. The spacetime diagram makes this clear. The whole person is the following object:  . He is spread out from left to right because he lasts over time; he begins to exist in 2000 A.D., and lasts for a number of years beyond that. The parts of the diagram,  ,  and  , represent some of his temporal parts.

A person's temporal part at a time is exactly the same, spatially, as the person at that time, but it exists only for a moment. Thus, the early temporal part  looks, feels and smells like a baby, but it lasts only for an instant. If you watch the baby for awhile, you will first be looking at one temporal part, then another much like it, then another much like the last one, and so on. If you watch long enough, you will notice that the later temporal parts are slightly bigger than the earlier ones. This is because the baby is growing. Accordingly, the leftmost temporal parts represented on the diagram are smaller than the rightmost temporal parts. For comparison, imagine looking at a person's wrist. Now move your gaze slowly up the person's arm, toward the shoulder. The arm in your field of vision "grows", from wrist size to shoulder size, since your eyes pass over different spatial parts of the person, first smaller parts (the wrist), then larger parts (the shoulder).

Temporal parts have spatial parts, and spatial parts have temporal parts. Consider the head of the person in the diagram:  . This representation of the head extends from left to right because heads, like persons, last over time. The head — a spatial part of the person — thus has temporal parts:  , and . Like the person, the head grows; its earlier temporal parts are smaller than its later ones. Now, consider one of these temporal parts of the head, the last one for example: . It is part of the last pictured temporal part of the person:  . In fact, it is a spatial part of this temporal part of the person. (Notice that the very same object, namely , is both a temporal part of a spatial part and also a spatial part of a

temporal part.)

The existence of temporal parts is just one way that I believe time to be like space. Here are two others (the nature of time is discussed more fully in chapter 5). 1. Time is like space regarding the *reality of distant objects*. Spatially distant objects, such as objects on Mars, are just as real as objects here on Earth. The fact that Mars is far away doesn't make it any less real; it just makes it harder to learn facts about it (we need a telescope). Likewise, I think, temporally distant objects, such as dinosaurs, are just as real as objects we experience now. The fact that a dinosaur is far away in time doesn't make it any less real; it just makes it harder to learn facts about it (we need to examine fossils). The belief that temporally distant objects are real is sometimes called "eternalism". (The main opposing view, "presentism", says that only objects in the present time exist.) 2. Time is like space regarding the *relativity of here and now*. When speaking to my brother in Chicago, if I say "here it is sunny" and he says "here it is raining", we do not really disagree. What is called "here" changes depending on who is speaking: I mean New Jersey, he means Chicago. There is no one true *here*. I think that the word 'now' works analogously. Imagine the dinosaur in the spacetime diagram above saying "It is now the Jurassic Period". I, on the other hand, say "It is now 2006". According to the relativity of 'now', the dinosaur and I do not really disagree. There is no one true *now*. What is called "now" changes depending on who is speaking: I mean 2006, the dinosaur means the Jurassic Period. The combination of this theory of the function of 'now' and eternalism is often called the "B-theory of time".

It is important to distinguish between the different facets of the space-time analogy, since some philosophers accept some facets while rejecting others.[2] Some accept the B-theory while denying the existence of temporal parts; and some embrace temporal parts while denying that time is like space in one or more ways. What I will defend here, however, is the "B-theory" version of temporal parts theory.

So: is temporal parts theory true? Do temporal parts *really exist* — do persons and other physical objects really have parts that last only for an instant? Temporal parts theory is a very general and speculative theory about the world, about what objects exist and what they are like. It is speculative because the question of its truth is hard to settle by observation or experiment.[3] Crudely put, objects look the same, whether or not they are made of temporal parts. Experiment and observation would be unnecessary if all rival theories were internally inconsistent; then we could deduce temporal parts theory from pure logic alone. Unfortunately this is not the case; there are internally consistent opposing theories.

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[2] The task of keeping the facets clearly distinguished is made more difficult by badly-chosen terminology: some philosophers use the term 'four-dimensionalism' for the doctrine of temporal parts alone, even though the term suggests the stronger claim that time and space are analogous in more ways. Another (better) bit of jargon is the following. To say that objects *perdure* is to say that they have temporal parts; to say that objects *endure* is to say that they do *not* have temporal parts.

[3] I do not say "impossible to settle"; science sometimes bears on metaphysical questions in unforeseen ways.

We cannot prove temporal parts theory, but never fear! I believe that assessing the philosophical case for temporal parts allows one to make a decent educated guess. I will consider the following arguments for temporal parts: i) the problem of change, ii) the paradoxes of material constitution, and iii) the argument from vagueness and anthropocentrism.

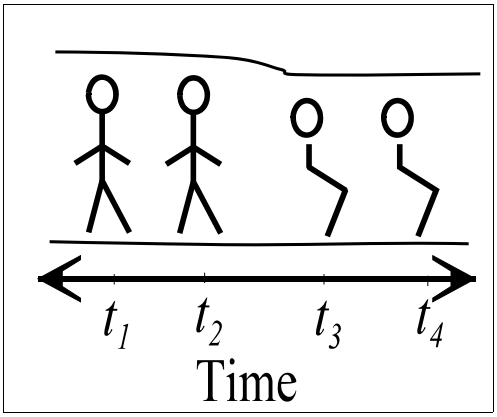
2. Change and temporary intrinsics

The oldest argument for temporal parts starts with the mundane fact that things change. Suppose that I am first standing, so that I am straight-shaped. Then I sit down, so I am bent-shaped. The standing person, call him Ted_1, seems to have different properties from the sitting person, call him Ted_2; only Ted_1 has the property *being straight-shaped*. But everyone agrees that *Leibniz's Law* is correct:

> Leibniz's Law: Objects *x* and *y* are identical only if they have exactly the same properties.

For if *x* and *y* are identical, then when we talk about *x* and *y*, we are talking about a single object, in which case it makes no sense to say that *x* has different properties from *y*. Leibniz's Law seems to tell us that Ted_1 and Ted_2 are not identical, since they have different properties. So, the argument concludes, Ted_1 and Ted_2 are distinct temporal parts of me.

This is a bad argument. Its flaw can be seen by viewing the situation from the perspective of a spacetime diagram. A spacetime diagram depicts the entirety of an object all at once. It is as if we take the perspective of God and look in on time from the outside; we take the "timeless perspective" on reality. From the timeless perspective, what properties do I — in my entirety — have? What am I like? The argument above spoke of properties such as "being straight-shaped" and "being bent-shaped", but in light of the spacetime diagram, it isn't right to describe me as simply being straight-shaped *or* as simply being bent-shaped, since I am straight-shaped at some times and bent-shaped at others. From the timeless perspective, it makes no sense to speak of properties like "being straight-shaped". Instead, we must speak of my shape *at various times*. Here, then, are the properties that I have from the timeless perspective:



(P) being straight-shaped at time t_1
being straight-shaped at time t_2
being bent-shaped at time t_3
being bent-shaped at time t_4

Moreover, *both* Ted_1 and Ted_2 have all the properties (P), for Ted_1 and Ted_2 are the very same object, namely, the person depicted in the diagram! The names 'Ted_1' and 'Ted_2' were introduced as names for "the standing person" and "the sitting person", respectively. But the

standing person and the sitting person are the very same person, namely, the person depicted in the diagram; namely, *me*. I am a person who was straight-shaped at times t_1 and t_2, and who was bent-shaped at times t_3 and t_4. So the argument goes wrong when it claims that Ted_1 and Ted_2 have different properties.

The argument fails. But some people think that further reflection on the subject of change leads to a new argument for temporal parts. Let's look more closely at the reply to the argument from change that was given in the previous paragraph.

The crucial move came when I said that the properties an object has are those it has from the timeless perspective. These properties, as we saw, are properties like *being straight-shaped at time* t_1. Call these *indexed* properties, since they involving "indexing" (or "relativizing") temporary properties (in this case, *being straight-shaped*) to times (in this case, t_1). Now, in addition to making the crucial move of saying that objects have indexed properties, a temporal parts theorist will want to go one step further, and say something about what having indexed properties amounts to. He will want to give the following temporal-parts theory of (at least some) indexed properties: a person is straight-shaped *at* time t_1 because that person's temporal part at t_1 is straight-shaped, period. A temporal part, unlike a continuing person, can be said to "have a straight shape, period" (as opposed to having a straight shape *at* one time or another), because a temporal part exists at only a single time. Temporal parts, unlike continuing objects, can have *non-indexed* properties.

An opponent of temporal parts, on the other hand, cannot take this further step, since the further step assumes that temporal parts exist. She will instead stop with the claim that Ted_1 and Ted_2 have the indexed properties (P); she will not go on to say that objects have indexed properties because of temporal parts with non-indexed properties.[4] For her, properties like shape are *fundamentally indexed*

Now for the new argument from change for temporal parts, put forward by David Lewis (1986, pp. 202-204). The new argument is in essence a complaint against fundamentally indexed properties. According to Lewis, certain properties — including shape properties — *must* be explained in terms of non-indexed properties:

> [According to the indexer,] shapes are not genuine intrinsic properties. They are disguised relations, which an enduring thing may bear to times. One and the same enduring thing may bear the bent-shape relation to some times, and the straight-shape relation to others. In itself, considered apart from its relations to other things, it has no shape at all. . . This is simply incredible. . . If we know what shape is, we know that it is a property, not a relation. (Lewis 1986, p. 204)

If fundamental indexing is no good, then shape properties must be explained in terms of non-indexed properties of temporal parts. Therefore, Lewis concluded, temporal parts must exist. This argument for temporal parts is known as the *argument from temporary intrinsics*.

Lewis's argument has been discussed extensively, especially his reason for claiming that

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[4] A complication: certain opponents of the B-theory can make a different reply to the argument from change than I made above, and so never need to appeal to indexed properties, and so escape Lewis's argument. See Zimmerman 2006.

shape properties must be explained in terms of non-indexed properties. Why is he so sure that "If we know what shape is, we know that it is a property, not a relation"? On one way of reading Lewis, the reason is that properties like shape are *intrinsic*. Intrinsic properties are those that are had by an object just in virtue of the way that object is, regardless of what other objects are like. Shapes are, Lewis thinks, paradigm examples. Extrinsic properties, on the other hand, depend on what other objects are like. *Being an uncle* is a paradigm example: whether you are an uncle constitutively depends not just on you, but also on other people; namely, on whether you have a niece or nephew. That is, it depends on whether you bear the *is an uncle of* relation to someone. (Extrinsic properties are sometimes called "relational".) Now, if shapes are indexed, so the argument goes, then shapes become just as extrinsic as *being an uncle*, for I have the properties in (P) in virtue of being related to other objects. Which other objects? *Times*. I have the property *being straight-shaped at time* t_1, for example, in virtue of bearing the *is bent-shaped at* relation to the time t_1.

This reason is not very convincing. Even if all properties turn out extrinsic in a sense, there may yet be an important difference between properties like shapes and properties like *being an uncle*. Only properties like the latter involve other *particular objects*, as opposed to times.[5]

Lewis might instead appeal to a fairly abstract metaphysical intuition. Late in the 19th century, British idealists like F. H. Bradley claimed that the world is a single interconnected whole. According to Bradley, to describe a single object, for instance a certain eight-ball, one must bring the entire world into the description. In addition to saying that the eight-ball is black, has a certain mass, and so on, one must also mention the eight-ball's distance from the cue ball. Not only that; one must also mention what is going on in the house next door, occurrences in other countries and other times . . . All these facts pertain equally to the eight-ball. We cannot separate the facts about the eight-ball into the facts about the eight-ball's intrinsic features and the facts about its relations to other things. Subsequent philosophers, notably G. E. Moore and Bertrand Russell, rejected this view emphatically. Against Bradley's holism, Moore and Russell advanced an opposing picture of a world of many separate little bits. Each bit can be described intrinsically without bringing in the rest. There are, of course, relations between the bits. A description of the world that characterizes the eight-ball perfectly, down to the last detail, and likewise for the cue ball, is not complete until it specifies the distance relation holding between the balls. Moore and Russell's complaint was not that Bradley accepted relational facts, for they accepted them too. It was rather that Bradley did away with intrinsic properties.[6]

Lewis's complaint about indexing is like Moore and Russell's complaint about Bradley. The indexer claims that all of reality is relational. No object is just plain straight, or just plain black, or just plain 50 grams. Objects are straight, black, or 50 grams, with respect to, or relative to, other objects (times). That, Lewis says, is implausible.

There may be something to this complaint, but it is nowhere near as forceful as Moore and Russell's complaint against Bradley, for the indexer's world is nowhere near as holistic as Bradley's. An indexer is free to agree that the eight-ball can be completely described without

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[5] See Haslanger 1989.

[6] This is merely a caricature; see Hylton 1990 for a historically responsible discussion.

bringing in the cue ball, let alone the house next door. The description must indeed bring in a time, but that is all.

Lewis's argument that shape properties are not indexed to times is based on the brute metaphysical intuition that *shape doesn't work that way*. Shapes are instantiated, period (not relative to a time); at the most fundamental level they are Moorean/Russellian non-relational properties. Unfortunately, Lewis's opponent is likely to flatly reject the alleged intuition. Of course, the fact that an opponent can reject the premises of an argument doesn't on its own show that the argument is no good, for it may be irrational to reject the premises. But in this case, it is hard to convict Lewis's opponent of irrationality. It is unclear how powerful Lewis's metaphysical intuition is.

3. The paradoxes of material constitution

Let us consider next a number of fascinating puzzles known collectively as the paradoxes of material constitution. Each consists of an argument for the apparently outrageous conclusion that two distinct objects can be made up of, or constituted by, the same matter. Call this conclusion "cohabitation", for it says that the same matter can be "inhabited" by two objects. The philosophical task is to say where the flaw in the argument lies, or, alternatively, to say why cohabitation is not as outrageous as it appears. Either approach requires developing a general theory of the nature of material objects. The argument for temporal parts lurking here is that the best approach to the paradoxes appeals to temporal parts. To show that this approach is the *best*, we must examine alternate approaches; that is the plan for this section and sections 3.1-3.5.

The paradoxes come in many forms. I will consider two: *the statue and the clay*, and *undetached parts*.

The statue and the clay: a sculptor begins on Monday with an unformed piece of clay, which she shapes on Tuesday into the form of a statue. We now argue as follows:

P1: The piece of clay that existed Monday continues to exist on Tuesday after being given statue shape
P2: The sculptor *creates* a statue, which exists on Tuesday but not on Monday
P3: If P1 and P2 are correct, then the statue and the piece of clay are two different material objects that on Tuesday are made up of exactly the same matter. They are not the same object because of Leibniz's Law: the piece of clay, but not the statue, exists on Monday.
C: Therefore, different material objects can be made up of the same matter at a single time

The argument is logically valid, and its premises seem correct, yet its conclusion seems false. That is the paradox.

Suppose the sculptor tires of the statue on Wednesday, and squashes it, seemingly destroying it. We can then form a parallel argument for the same conclusion:

P1´: The piece of clay that composes the statue on Tuesday is not destroyed when it is squashed, so it continues to exist after Wednesday
P2´: The statue that exists on Tuesday is destroyed when it is squashed, and so does

not exist after Wednesday

P3′: If P1′ and P2′ are correct, then the statue and the piece of clay are two different material objects that on Tuesday are made up of exactly the same matter. They are not the same object because of Leibniz's Law: the piece of clay, but not the statue, exists after Wednesday

C: Therefore, different material objects can be made up of the same matter at a single time

Undetached parts: in addition to its tail, legs, head, and so on, a cat also has larger parts, for instance its *torso*: all of the cat except for the tail. Consider now a certain cat, Tibbles, and its torso, Tib. Unfortunately for Tibbles, on Tuesday its tail is chopped off and the tail's matter is destroyed. We now argue as follows:

P4: Tibbles exists on Tuesday, since a cat can survive the destruction of its tail

P5: Tib exists on Tuesday, since chopping off the tail did not affect Tib at all; it merely removed an external object that was once attached to Tib

P6: If P4 and P5 are correct, then on Tuesday, Tibbles and Tib are two different material objects made of the same matter. They are not the same object because of Leibniz's Law: Tibbles, but not Tib, had a tail as a part before Tuesday

C: Therefore, different material objects can be made up of the same matter at a single time

Again, the argument's premises seem correct, yet its conclusion seems false.

To get an intuitive handle on what is going on with these arguments, the concept of "tracing" is helpful. Suppose you are given the task of tracing a certain object through time. This, you are told, means ascertaining where this very object has been in the past, and where it will be in the future. What information will you need to accomplish the task?

One thing you will need to know is what *sort* of thing your object is. We ordinarily think of the world as involving objects of various sorts: pieces of clay, statues, cats, and so on. These objects persist over time, through various changes. Cats age; pieces of clay change their shape. But a cat or a piece of clay cannot survive just any change: some changes *destroy* a thing. Dismembering a cat destroys it; we do not think of the resultant body parts as being the same object as the cat. Furthermore, other changes *create* a new thing. Sculpting a piece of clay, we ordinarily think, creates a statue. Finally — and here is the crucial bit — whether a given change destroys a thing, or creates a new thing, depends on what sort of object that thing is. Sculpting the clay creates a statue; it does not create a new piece of clay. Being squashed flat destroys a statue but not a piece of clay. At least, that is what we ordinarily think. So, since tracing an object requires ascertaining when it was created, and which changes it survives (since we must ascertain whether *the very same object* is present at different times) tracing an object requires knowing what sort of thing it is.

The paradoxes of constitution are based on this fact, that different sorts of objects are associated with different criteria for tracing. Each argument shows that two paths of tracing can intersect at a location that appears to contain only a single object. In the statue/clay case, for instance, *piece of clay* tracing begins before Monday, leads to the clay in statue form on

Tuesday, then extends beyond Wednesday to the clay in squashed form. *Statue* tracing has a different starting point: it begins on Tuesday when the sculptor's work is done, but also leads to the clay in statue form; it then ends on Wednesday when the statue is squashed. Our ordinary beliefs associate an object with each way of tracing, and so lead to two objects made up on Tuesday of the same clay, at the point where the paths of tracing intersect.

We have, then, three arguments for the apparently absurd conclusion of cohabitation. The challenge is to find a reason to think that cohabitation is not as outrageous as it seems, or a reason to reject a premise from each argument. Either sort of reason requires articulating a general theory of material objects. As we will see at the end, temporal parts theory is one such theory, but first let us examine some rivals.

3.1 The constitution view

One of the most popular responses to the arguments is simply to accept cohabitation. This response has the advantage of taking all of our beliefs about tracing seriously. We want to trace pieces of clay as well as statues, and torsos as well as cats. As the arguments show, this leads to admitting the possibility of two different objects sharing exactly the same matter. The *constitution view* simply embraces this conclusion (without admitting the existence of temporal parts).

Since the statue and the piece of clay share the same matter, they are *extremely* similar. Obviously, the piece of clay is exactly the same mass, shape, size, and smell as the statue. Now, a perfect replica of a statue, made by a master forger, would also share these qualities. But the piece of clay is far more similar to the statue, for it is made of the very same matter. It is in exactly the same place as the statue. How, then, can it be a different object?

Defenders of the constitution view say that the statue and the piece of clay can be different objects despite being so similar because each is *constituted* by the same matter. Constitution is the relationship that holds between a thing and the quantity of matter that makes it up. But speaking of "constitution" does not *explain* how cohabitation is possible; it merely places a label on a problem.

And there is indeed a problem. Let me mention two arguments that have been put forward against the constitution view. First: according to the constitution view, squashing the statue destroys the statue, but does not destroy the piece of clay from which it is made. Thus, the statue is vulnerable to destruction in a way that the piece of clay is not. But how can that be? The vulnerability of a thing to destruction, one might have thought, is a function of what that thing is made of; but the piece of clay and the statue are made up of the same matter.

The second argument appeals to abstract considerations about parts and wholes. The constitution view says that two wholes can be made up of the very same parts. It therefore implies that a whole object is something "over and above its parts", for if wholes were nothing over and above their parts, you could never get two wholes out of the same parts. But in fact, wholes are not extra entities, over and above their parts. Subtract away a thing's parts, and there is nothing left. Would it make sense to paint every part of a house red, but claim that the house itself had not changed color one bit? Of course not! — the house just *is* its parts; that is why its parts cannot change while it remains the same (Sider 2007).

These arguments have detractors as well as proponents. But, for these or other reasons, many philosophers remain suspicious of simply accepting cohabitation. How else might we

respond to the paradoxes?

3.2 Mereological essentialism

Upon completing her work, the sculptor holds her handiwork aloft. If we reject cohabitation, we must say that only one object is in her hands. That apparently means choosing a *single* method of tracing. But how can we choose? Does she hold a statue or a piece of clay? *Mereological essentialism* provides a way of choosing a single method of tracing in every case. That method of tracing is: always trace under the sort *quantity of matter*.

Mereological essentialism is the claim that the part is essential to the whole ('mereological' means pertaining to parts and wholes).[7] It says that the only objects that exist are *quantities of matter*, which are things that are defined by their parts. The only way to create one is to create some new matter. Changing or rearranging old matter alters pre-existing quantities of matter, but does not bring new quantities of matter into existence. And the only way to destroy one is to destroy some of its matter. Rearranging or changing that matter just alters the features of the quantity of matter, but does not destroy it. Thus, whenever we want to trace an object, we simply trace according to its matter. As we will now see, this lets us reject the arguments for cohabitation.

According to mereological essentialists, the mistaken steps in the statue/clay arguments are P2 and P2´. P2 says that shaping the piece of clay into statue form *creates* something, namely the statue. That is false, according to mereological essentialism, because shaping the piece of clay into statue form does not create any new matter. It merely alters the shape of a certain quantity of matter (the piece of clay), from lumpy to statue-shaped. Likewise, P2´ is false: squashing the statue does not destroy it, for what we call "the statue" is just a quantity of matter, and squashing it does not destroy any of its matter. In the undetached parts argument, P4 implies that Tibbles exists even after the matter in its tail is destroyed; that premise is false, according to mereological essentialism, because no object can survive the destruction of any of its matter.

Mereological essentialism does indeed avoid the paradoxical conclusion of the arguments, but it does so by claiming that most of our ordinary beliefs about tracing objects are badly mistaken. Our ordinary beliefs say that dismembering a cat destroys the cat. But not according to mereological essentialism! — dismemberment destroys none of the cat's matter. The mereological essentialist may respond that once dismembered, the object we formerly called "the cat" can no longer be called a cat. This is correct, but nevertheless, the original *object* — a quantity of matter, according to the mereological essentialist — still exists. Moreover, our ordinary beliefs for tracing cats say that a cat changes its matter over time. My cat Sada was sixteen years old when she died in 2005. If asked to trace her back in time, I would trace her back to a small black kitten living in Rochester, NY in 1989. But the matter making her up when she died was completely different from the matter that made up that kitten. The quantity of matter, M, that made up Sada in 2005 was scattered across the surface of the Earth in 1989; it did not then make up a kitten. If Sada *is* the quantity of matter M, as mereological essentialists say, then tracing Sada back to the small black kitten in Rochester is incorrect; one must instead trace

[7] See Chisholm 1976, chapter 3.

her back to a quantity of matter scattered over the surface of the Earth. Indeed, we could trace Sada back even further, hundreds of years back in time, back to any time at which all the matter in quantity M existed.

Thus, mereological essentialism says that our ordinary beliefs about tracing cats are incorrect. For similar reasons, mereological essentialists must reject our ordinary beliefs about tracing most other sorts of objects as well. The only sort we trace correctly is *quantity of matter*.

Perhaps we really are drastically mistaken in this way. If there is no better way to answer the paradoxes of constitution, our only recourse would be to grit our teeth and accept mereological essentialism. But first, let's see whether there is a better choice.

3.3 Dominant sorts

Avoiding cohabitation requires choosing a single method of tracing in any given case. Mereological essentialism told us always to trace according to a single sort, namely the sort *quantity of matter*, but that led to an unappealing result. Perhaps we should instead choose different sorts in different cases. We could trace statues under the sort *statue*, cats under the sort *cat*, and so on.

If an object falls under just one sort, then of course we trace under that sort. But in most cases, objects fall under more than one sort. Our clay statue falls under both *statue* and *piece of clay*. Under which sort should we trace? Tracing it under the sort *statue* leads to saying that it began existing on Tuesday, when the sculptor formed the clay into statue shape, and ceases to exist when flattened on Wednesday. Tracing it under *piece of clay* leads to saying that it existed already on Monday, and continues to exist after Wednesday. Which answer is correct?

According to Michael Burke (1994), we must always trace under an object's *dominant* sort. A clay statue's dominant sort is *statue*, Burke says. Thus, the statue did not exist on Monday. The statue, therefore, is not the same object as the unformed piece of clay with which the sculptor began on Monday. Now, Burke rejects cohabitation, and so agrees that the statue is the *only* object present on Tuesday. And the unformed piece of clay is not identical to the statue, since the statue does not exist on Monday whereas the unformed piece of clay obviously does. That means that the unformed piece of clay does not exist on Tuesday. Thus, that unformed piece of clay is destroyed when kneaded into statue shape. The premise in the first statue/clay argument that Burke rejects, therefore, is P1.

For parallel reasons, Burke rejects P1´ in the second statue/clay argument. The dominant sort of the piece of clay which constitutes the statue on Tuesday (i.e., the statue itself) is *statue*. We trace its future, therefore, under the sort *statue*, and so it ceases to exist when squashed.

What of Tibbles and Tib? Burke rejects P5. On Monday, Tib is a large part of Tibbles. Its dominant sort is *torso*. It does *not* fall under the sort *cat*, because it is a mere part of a cat. On Tuesday, however, after the tail is destroyed, a single object falls under both *cat* and *torso*. Of these two sorts, the first is dominant, so we trace the past of the one and only object on Tuesday back to Tibbles the cat, not Tib the torso. The Tuesday object, therefore, is identified with Tibbles, not Tib. There is no other object on Tuesday for Tib to be. Tib, therefore, stops existing when the tail is destroyed, even though the tail was merely attached to Tib, not part of it.

Burke's solution to the paradoxes is ingenious but problematic. There is first the problem of saying what makes a given sort dominant. The problem is particularly pressing in certain cases. Imagine a statue made from a single living tree that has been pruned and

constrained to grow into a desired form. Is that object's dominant sort *statue* or *tree*?[8]

There is also a problem of anthropocentrism. Imagine a tribe of aliens who trace objects over time very differently. They have no sorts like *statue* and *piece of clay*; instead they trace under the following sorts:

> ***outpiece*:** piece of clay located outdoors, no matter how shaped
> ***inpiece*:** piece of clay located indoors, no matter how shaped[9]

According to the members of this tribe, pieces of clay and statues do not exist. There exist instead inpieces and outpieces. When an inpiece or an outpiece changes shape, that is irrelevant to its continued existence, and does not cause any new thing to exist. What *does* cause a new thing to exist is taking an outpiece indoors. When that happens, according to the members of this tribe, the original outpiece stops existing and a new object, an inpiece, comes into existence. This inpiece exists so long as it stays indoors. But if it is taken outdoors, it stops existing and is replaced by a new outpiece.

Burke is committed to saying that the members of this tribe are *wrong* in what they say about persisting objects. Think of our statue/clay case. Burke rejects cohabitation, and claims that the one and only object that exists Tuesday (a statue) did not exist Monday, even though it was then indoors. But the members of the tribe say that the one and only object that exists Tuesday (an inpiece) *did* exist Monday (because the formation of an inpiece into statue shape is irrelevant to its continued existence.) Thus, according to Burke, the world contains statues and pieces of clay; and it does not contain inpieces and outpieces. But shouldn't Burke be worried that it is he, rather than the members of the tribe, that is mistaken? It feels suspiciously convenient that the objects in the world just happen to exactly match the sorts that *we* have words for, rather than the sorts that the members of the tribe have words for. Our decision to have a word for, and trace under, *statue* rather than *inpiece* feels like an arbitrary decision; but for Burke, it is one of vital ontological importance. Burke's worldview is anthropocentric: it elevates arbitrary human decisions into serious ontology.

Finally, Burke's claims clash with our ordinary practices of tracing. No one other than a philosopher would dream of saying that an unformed piece of clay can be destroyed simply by kneading it into a more interesting shape! The slogan with which I introduced the theory sounded plausible: "always trace an object by its dominant sort". But in fact, Burke cannot really adhere to this slogan. If he did, he would have to admit that the unformed piece of clay survives the sculptor's kneading after all. For the unformed piece of clay's dominant sort is *piece of clay*, and tracing under that sort yields the conclusion that it survives the kneading. There is no way to hold onto everything we want, by tracing every object under its dominant sort (assuming we want to deny cohabitation). The dominant sort of the unformed piece of clay on Monday is *piece of clay*, which leads us to identify the piece of clay with the statue on Tuesday, but the dominant sort of the statue on Tuesday is *statue*, which leads us to reject the

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[8] See Rea 2000.

[9] Compare Eli Hirsch's (1982, p. 32) "incars" and "outcars".

identification.

3.4 Nihilism

In any given case, under which of the available sorts must we trace? Burke and the mereological essentialists say: *one*. (For Burke, the sort varies from case to case; for mereological essentialists the sort is always *quantity of matter*.) That leads to the right *number* of objects in every case — one — but, as we saw, it leads to some unappealing conclusions about what those objects are like. Constitution theorists say *all*. That leads to cohabitation — too many objects. A remaining logical possibility is to trace under *no* sorts at all. That would lead to saying that there are no objects involved in the puzzle cases, for if there were objects involved, we would have to trace them in some way or other. *Nihilists* claim just this. None of the objects in our puzzle cases — statues, pieces of clay, cats, torsos — exist at all, and so the puzzles never arise.[10]

Nihilists do not quite deny the existence of *everything*. They believe in *mereological simples* — things with no smaller parts. If current physics is on the right track, these are subatomic particles like quarks and electrons. According to nihilists, the quarks and electrons are fine; it is mereologically complex things, larger things with smaller parts, that cause all the trouble. Complex things can be traced over time in different ways, which leads to the paradoxes of constitution. Mereologically simple things are more theoretically tractable. They can be traced over time in only one way, and therefore do not lead to paradoxes.

"Of *course* statues exist!", one wants to say, but matters are not so clear. Though the nihilist says that the statue does not exist, he accepts the existence of (an immense number of) simples, which are "arranged statuewise". "Arranged statuewise" does not mean *arranged so as to compose a statue*; rather, it means something like: *arranged in a way that would compose a statue if nihilism were false*. Though nihilists do not believe in cats, or torsos (or planets, or people), they do believe in all the subatomic particles that the rest of us believe in, some of which are arranged catwise, others torsowise, others planetwise, others personwise. One cannot tell simply by looking that statues exist, for the visual sensations most of us attribute to statues could just as easily be caused by mere simples arranged statuewise.

Then again, none of the views we have been considering can be refuted just by looking. You cannot tell, just by looking, whether cohabitation is true: since the allegedly distinct statue and piece of clay would be made up of exactly the same matter, they would look exactly like a single object. You cannot tell, just by looking, whether the mereological essentialist is right that the dismembered cat keeps existing, since you cannot tell, just by looking, whether objects at different times are identical. Objects do not have name tags.

If you cannot tell which metaphysical theory is true just by looking, then how *do* you tell? That is a very hard question, and not one that I will try to answer in any general way. But thus far we have been holding the other views up to the following standard: a good view of constitution must not clash too much with our ordinary beliefs about objects and persistence. Judged by this standard, nihilism looks pretty bad.

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[10] See Merricks (2001, chapters 1, 2) for a nihilistic solution to the puzzle of the statue and the clay. (Merricks is not a nihilist, however: he believes that living things exist.)

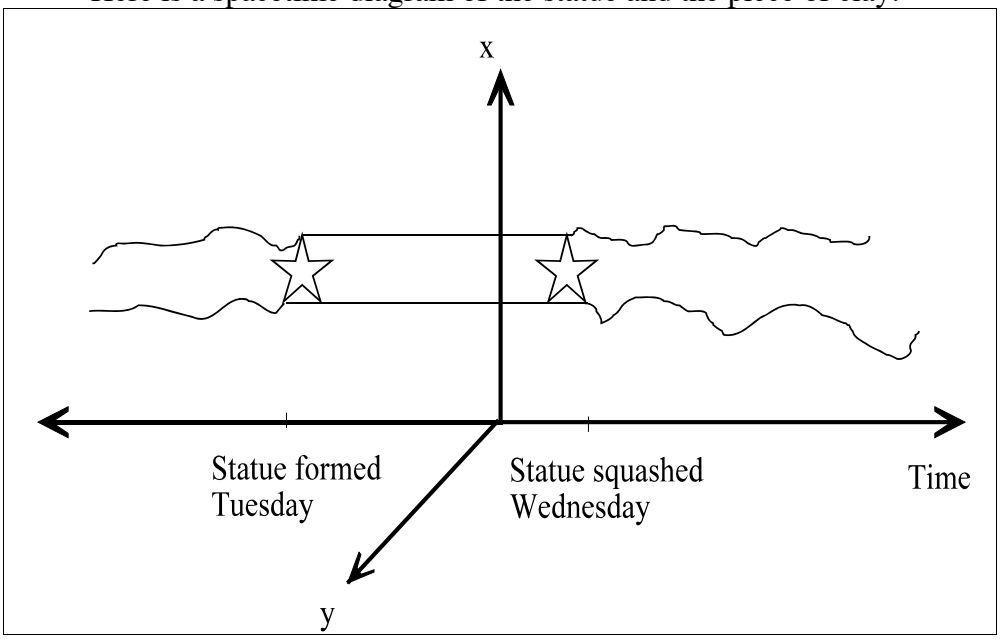
Nihilism also rests on a substantial empirical hypothesis, which may for all we know be false. The nihilist avoids utter absurdity only because he follows up his denial of the existence of statues by saying: "Still, there *do* exist simples arranged statuewise". But is it clear that there exist any simples at all? Scientists initially thought that the atoms of chemistry had no smaller parts. Then electrons were discovered, then protons and neutrons. Protons and neutrons were later discovered to be composed of yet smaller particles, quarks. Perhaps this process will continue forever; perhaps absolutely *every* object has smaller parts. If so, then there is no escape from complex objects, and the puzzles of constitution to which they give rise.

3.5 Temporal parts to the rescue

As we will now see, temporal parts theory resolves the paradoxes of constitution. Together with the previous four sections, which found the competing accounts wanting, this completes the constitution argument for temporal parts.

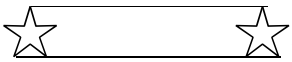
The paradoxes arise from the multiplicity of methods of tracing: we want to trace both statues and pieces of clay, and both cats and torsos. In different ways, mereological essentialists, Burke, and nihilists deny the multiplicity. That leads to trouble, as we saw. What we really want is to accept the multiplicity. That leads to cohabitation, which initially seems absurd. What we really need, then, is a way to accept cohabitation and dispel the impression of absurdity. The constitution view attempted this, but failed (section 3.1). Temporal parts theory gives a better explanation of why cohabitation is not absurd after all, and therefore gives us a satisfying way to embrace the conclusion of the paradoxical arguments for cohabitation.

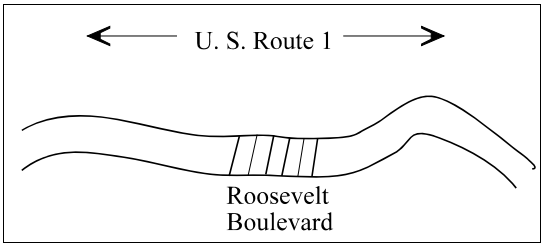
Here is a spacetime diagram of the statue and the piece of clay:



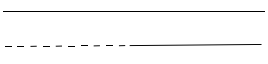
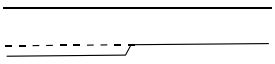
Space-Time Diagram

The piece of clay first has a lumpy shape, then is formed into a statue of a star, then is squashed back into a lumpy shape again. According to temporal parts theory, statues and pieces of clay are aggregates of temporal parts — "spacetime worms" as they are sometimes called. Thus, the

statue is the following object:  . It is an aggregate of temporal parts, each of which has a statue shape. The piece of clay is a larger aggregate of temporal parts:  . In addition to the temporal parts that make up the statue, the piece of clay contains earlier and later temporal parts that do not have statue shape. Now, these two spacetime worms are not the same object; the piece of clay is longer in time. Thus, the spacetime diagram depicts the truth of cohabitation — both spacetime worms are represented as being present between Tuesday and Wednesday, when the piece of clay has statue shape. But the worms are intimately related: the statue worm is *part* of the piece of clay worm. Thus understood, cohabitation does not seem strange at all! When the sculptor holds the statue in her hand, she holds a single temporal part, which is part of both the statue and the piece of clay:  . That temporal part is the only object she directly holds. She *indirectly* holds both the piece of clay and the statue in her hands, for the temporal part is part of each, just as you indirectly touch a person when you directly touch his nose.



The case of the statue and the piece of clay may be illuminated by a spatial analogy. A portion of U.S. Route 1in Philadelphia is called the Roosevelt Boulevard. The Boulevard is not the same road as Route 1, since it is much shorter. Thus, a motorist in Philadelphia drives on two roads at once, Route 1 and the Roosevelt Boulevard. The roads "cohabit" in Philadelphia. But there is nothing strange about this; the Boulevard is *part* of Route 1.

A spacetime diagram of Tibbles and Tib reveals a similar moral. Tib, the torso,  , is a part of the entire cat Tibbles:  (the tail, , is initially present but is then destroyed.) Consider again a spatial analogy: a four-lane road traveling left to right in which the fourth lane on the bottom merges into the road and disappears.

Pictures are not enough; the temporal parts theorist must answer the objections to cohabitation from section 3.1. The objections undermined the constitution view, but they have no force against temporal parts theory. Let's take them in reverse.

The second objection was that Cohabitation violates the principle that a single set of parts cannot compose two different wholes. Given temporal parts theory, the principle is not violated at all. The spacetime diagram clearly shows that the statue and the piece of clay do *not* have exactly the same parts. The piece of clay has far more parts than the statue, since it has temporal parts located to the future of the statue:  as well as to the past of the statue:  . The statue and the piece of clay appear to have the same parts only when we neglect the fourth dimension of time. Likewise for Tibbles and Tib.

The first objection asked how the statue could be so vulnerable to destruction when it is

made of exactly the same material as the piece of clay. But no one wonders why the Roosevelt Boulevard stops existing at the city limits of Philadelphia, despite being made of the same asphalt as Route 1, which continues north into New Jersey. Like any road, Route 1 has many parts. Some extend beyond Philadelphia, and some do not. The good people of Philadelphia saw fit to apply the words 'The Roosevelt Boulevard' to one of the stretches that ends at the city limits. Similarly, according to temporal parts theory, any piece of clay has temporal parts. Some of these are statue-shaped throughout their temporal length, others are not. We speakers of English have decided to use the word 'statue' only for the temporal parts of pieces of clay that are statue-shaped.

The first objection is puzzling because of a mistaken picture of the statue and the piece of clay as both being "directly" present on Tuesday. The correct picture is that only a single object — the Tuesday temporal part, common to each — is directly present. The statue and the piece of clay are indirectly present on Tuesday by containing that temporal part. If both the statue and the piece of clay were directly present, perhaps their survival or destruction would depend on their Tuesday qualities, in which case we would indeed face the question of how the statue could be so fragile when the piece of clay is so robust. But since the only thing directly present is the current temporal slice of both the statue and the piece of clay, what happens afterward is just a function of the qualities of the slice, and what the sculptor does to it. If she squashes it then future clay temporal parts will have lumpy shapes; if she leaves it alone then those temporal parts will continue to be statue-shaped. There is then the question of what we will *call* various aggregates of temporal parts. We reserve the word 'statue' for aggregates of statue-shaped temporal parts. So if the sculptor squashes the statue and the further temporal parts have lumpy shapes, only the aggregate terminating at the squashing counts as a "statue".

4. The argument from vagueness and anthropocentrism

The final argument for temporal parts that I want to give employs the concept of *tracing* that figured so prominently in the last section.[11] Tracing is charting the histories of objects. If I know how to trace statues over time, then if you give me appropriate information about what happens at various times (for instance, facts about pieces of clay and how they are shaped), then I will be able to tell you when statues begin to exist, and when they cease to exist. More generally, if I know how to trace *all* objects, that means I can tell you when *any* object begins to exist, and when it stops existing, provided you give me appropriate information about what happens at various times.

So far we have been using the concept of tracing informally, but since it will be the focus of this section's argument, let's make the concept more rigorous by carefully defining some terms. By a **tracing scenario**, I will mean i) a series of times, the **tracing times**, and ii) various objects at each of those times, the **tracing objects**. To illustrate, consider two examples of tracing scenarios. Scenario 1: the tracing times are all and only the times when our piece of clay from the previous section is shaped into statue form; the tracing objects at each moment are the parts of the clay. Scenario 2: the tracing times are all and only the times at which Tibbles the cat

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[11] I discuss this argument in more detail in Sider 2001, section 4.9. It is based on an argument given by David Lewis (1986, pp. 212-213).

exists; at each moment, the tracing objects are the particles that make up Tibbles at that moment. Notice that in scenario 2, the tracing objects vary from one tracing time to another, since Tibbles, like all cats, has different parts at different times.

Let's focus on scenario 2, and in particular on how it relates to Tibbles. The tracing scenario is the *entire life history* of Tibbles. For:

i) The tracing scenario contains *exactly* the moments at which Tibbles exists. (If we had chosen one of the tracing moments hundreds of years beforehand, or if we had included only a part of Tibbles's life, this would not have been the case.)
ii) At each moment of the tracing scenario, Tibbles is exactly composed of the tracing objects, no more, no less. (If we had left out Tibbles's whiskers, or had included extra objects, for example one of Tibbles's toys, this would not have been the case.)

In light of this, let's introduce another concept. Let's call Tibbles the **tracing target** of scenario 2. An object *x* is the tracing target of scenario S if and only if i) S contains exactly the moments at which *x* exists, and ii) at each moment of S, *x* is exactly composed of the tracing objects for that moment. As another example of how this concept functions, notice that the statue is the tracing target of scenario 1. Scenario 1 contains exactly the moments at which the statue exists, and at each such moment, the statue is exactly composed of the tracing objects — the parts of the piece of clay.

More cautiously: the statue and Tibbles are the tracing targets of scenarios 1 and 2 *according to our ordinary beliefs about tracing*. A mereological essentialist, for example, would deny each of these claims. In fact, a mereological essentialist would say that neither tracing scenario has any tracing target at all. A tracing target for scenario 2 by definition must be composed of different objects at different times, since the tracing objects of that scenario vary between its tracing times. Mereological essentialism prohibits the existence of any such object, because mereological essentialism says that the only objects that exist are quantities of matter, which have the same parts at all times. Thus, scenario 2 has no tracing target whatsoever, if mereological essentialism is correct. The mereological essentialist would also deny the existence of a tracing target for scenario 1, but for a different reason. Scenario 1 contains tracing times only when the piece of clay is statue-shaped. But a tracing target of a scenario exists *only* at the scenario's tracing times. Thus, a tracing target of scenario 1 would have to come into existence when the piece of clay is statue-shaped, and go out of existence after it ceases to be statue-shaped — i.e., when the "statue" is squashed. According to mereological essentialism, no such object exists, for a quantity of matter continues to exist so long as its matter does; the shape of the matter is irrelevant.

Thus, the question of which tracing scenarios have targets and which do not is precisely the question of how to trace objects over time. Let's look at one more example. Suppose we define scenario 3 as a part of the case of the statue and the piece of clay: the tracing times are the times in the history of the piece of clay *before* the clay is sculpted into statue shape; the tracing objects are, at each moment, the parts of the piece of clay then. Does this scenario have a tracing target? Since we included only times before the piece of clay was formed into statue shape, a tracing target of scenario 3 would go out of existence when the clay is sculpted. Now, Michael

Burke, as we saw in section 3.3, thinks that such an object exists, for according to him, sculpting the clay into statue form destroys the original piece of clay. (It goes out of existence to "make room for" the statue.) Many others disagree that any such object exists. Again, the question of which tracing scenarios have targets is exactly the question of how to trace objects over time.

Thus, all the theories of constitution from the last section make claims about which tracing scenarios have tracing targets. Burke would say that scenarios have targets depending on how dominant sorts apply. Mereological essentialists would say that a scenario has a target when and only when it is the entire history of some portion of matter, no matter how arranged. Nihilists would say that scenarios almost never have targets, since a target must be made up of the tracing objects at the tracing times. (The exceptions are scenarios with just one tracing object, a particle, and tracing times matching the particle's career; then the target object is that particle.) Defenders of the constitution view would say that "overlapping" tracing scenarios — scenarios with a common time and set of tracing objects for that time — can both have target objects. Let Scenario 4 consist of all the times when the piece of clay exists; let the tracing objects be the parts of the piece of clay at each moment. Notice that scenario 4 overlaps with scenario 1 during the times when the clay is statue-shaped, for each scenario contains these times, and contains as tracing objects then the parts of the piece of clay. Scenario 4 differs from scenario 1 by containing some additional times, namely, times at which the clay is not statue-shaped. The defender of the constitution view would say that *both* scenarios 1 and 4 have targets. The target of scenario 1 is the statue; the target of scenario 4 is the piece of clay. At the times common to both scenarios, the statue and the piece of clay both exist, and are made up of exactly the same parts.

What theory of tracing is implicit in temporal parts theory? A fairly extreme one, as it turns out: *all* tracing scenarios have targets.[12] The target for any scenario is just a spacetime worm consisting of temporal parts for each of the tracing times in the scenario. The target of scenario 1 is the aggregate of all the temporal parts of the piece of clay while it has statue form; the target of scenario 4 is the aggregate of all the piece of clay's temporal parts, whether or not those temporal parts have statue form. (That is, the target of scenario 4 is the piece of clay itself.) Even if a scenario contains times scattered from different periods in history, there will still be a target. Let scenario 5 consist of times in the Jurassic period when the dinosaur pictured in section 1 exists, plus the times in the present when the statue we have been discussing exists. The tracing objects for the first times are the parts of the dinosaur; the tracing objects for the second times are the parts of the piece of clay. What would a tracing target for this scenario look like? It would need to be an object that started existing in the Jurassic period shaped as a dinosaur, which stopped existing until the present time, and which then resumed existing in the present time shaped as a statue. A strange object? Not at all — it is simply the spacetime worm consisting of the dinosaur's temporal parts, plus the statue's temporal parts. This dinosaur+statue is the target of scenario 5.

Thus, if temporal parts theory is correct, all scenarios have targets. In fact, the converse is also true: if all scenarios have targets then temporal parts theory is correct. For there exist

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[12] Given the doctrine of unrestricted composition, anyway, which I have been assuming throughout this chapter. See chapter 8.

scenarios concerning only one time. Let scenario 6 consist of just one tracing time, the present moment, and let the tracing objects be my current parts. If all scenarios have targets, then scenario 6 must have a target. A target, by definition, exists only at the tracing times. That means that a target of scenario 6 exists only at the present moment, and is currently composed of the same parts as me. This object must be my current temporal part! We can repeat the argument for any chosen object at any time: simply choose a scenario consisting of that object's parts at that time, and infer the existence of a temporal part then from the fact that all scenarios have targets. This means that, in order to argue for temporal parts theory, all we must do is argue that all scenarios have targets.

Some scenarios have targets, since some objects exist. So anyone who denies that *all* scenarios have targets must draw a line somewhere, between the scenarios that have targets and those that do not. But such a line turns out to be very difficult to draw, for two reasons. First, the line must not be *anthropocentric*, and second, it must not be *vague*.

Our natural inclination is to trace objects over time according to our ordinary beliefs about tracing. We want to accept ordinary objects like statues and pieces of clay, people and planets and so on, whereas many of us do not want to accept strange objects such as inpieces and outpieces, or temporal parts (not initially, anyway). But keeping just the ordinary objects while rejecting the strange objects requires drawing an anthropocentric line between tracing scenarios. We seem to be choosing statues and pieces of clay over inpieces and outpieces just because we humans have words for the former. Burke ran into this trouble in section 3.3: he had to say that the members of the alien tribe, who believe in inpieces and outpieces, were simply wrong, even though they seem merely to have a different language from ours. Temporal parts theory avoids this problem by saying that inpieces and outpieces exist in addition to statues and pieces of clay. An inpiece or an outpiece is just another spacetime worm, just as good an aggregate of temporal parts as any other.

In addition to requiring an anthropocentric line between tracing scenarios that have targets and those that do not, accepting just the ordinary objects would also require a *vague* line. An example of a vague concept is *baldness*. Some people are clearly bald; others are clearly non-bald. But some people cannot be classified as either bald or non-bald; they are *vague*, or *borderline*, or *blurry* cases. They are just sort-of-bald-and-sort-of-non-bald. *Existence*, on the other hand, is not vague. It makes no sense to speak of an object that "just sort-of exists". No matter how small you shrink a thing, no matter how insignificant you make it, it is still there, definitely existing — unless you shrink it down to nothing at all, in which case it definitely does not exist! But if we wanted to say that only the ordinary objects exist, we would need to admit that existence can be vague after all, for our ordinary beliefs do not define precise conditions, down to the tiniest detail, governing when a tracing scenario has a target that is a *statue*, *piece of clay*, *person* or *planet*. For any of these concepts — *statue*, *piece of clay*, *person* or *planet* — we can define a tracing scenario in which it is vague whether there exists any ordinary object that is its target. Simply begin with a scenario that definitely *does* have an ordinary object as its target, a statue, say. Now, a tiny bit at a time, change the scenario; change the properties and configuration of its tracing objects and tracing times, gradually making it less like the scenario of a statue. If you continue in this way, you will eventually reach a scenario that definitely does not have a statue as a target, but long before that you will reach cases where the existence of a statue is simply indeterminate, unclear, blurry. If the only tracing scenarios that have targets are those

corresponding to ordinary objects, then we will need to say that what *exists* is likewise indeterminate, unclear, blurry. But as we saw, this makes no sense. Temporal parts theory avoids this problem by not limiting the things that exist to those that satisfy vague ordinary concepts.

So, suppose you think that not all tracing scenarios have targets. You then have to draw a line — between those tracing scenarios that have targets and those that do not. And you face a choice of what kind of line to draw. On the one hand, you could draw a *moderate* line: a line that fits our ordinary beliefs about tracing. But as we have seen, this line would need to be vague and anthropocentric; and I argued against drawing such a line. On the other hand you could draw a *drastic* line: a line with no basis in our ordinary beliefs about tracing, but which is neither anthropocentric nor vague. Nihilism and mereological essentialism would do this, but I have already said why I think those views are mistaken. I think you have backed yourself into a corner. And here's how to get out: *draw no line at all*, say that all scenarios have targets, and so embrace temporal parts.[13]

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[13] For further reading on the topics in this chapter, see Haslanger 2003, Hawley 2001, Heller 1990, and Sider 2001.

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