THE PERSISTENCE OF

PHYSICAL OBJECTS

by
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A dissertation submitted in partial fulfillment
of the requirements for the degree
Doctor of Philosophy
(Philosophy)
in The University of Michigan
1979

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ACKNOWLEDGEMENTS

This dissertation would not have been possible without the guidance and support of one person--Tim McCarthy. His willingness to spend an inordinate amount of time patiently working with me was truly extraordinary. Jaegwon Kim contributed to the evolution of this project by supervising my early journeys into metaphysics.

Certain other people have been sources of inspiration. Jack Worley, my first philosophy teacher at Grinnell College, opened up the world of reflection to me. My close friend Nancy put up with me throughout the writing of this work. Most importantly, my parents have encouraged me in countless ways in whatever I have chosen to do.

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CHAPTER I

INTRODUCTION

Metaphysics is the study of the most fundamental concepts used to describe the physical world. This dissertation undertakes a metaphysical examination of our concept of a physical object's persistence through time. Certainly, the concept of a persisting physical object is at the core of our ordinary ways of thinking about the world. The philosopher's challenge is to see if anything broad and systematic can be said about such a concept.

When inquiring into an object's persistence through time, we are asking for a characterization of the unity of a physical object's history. The object's history stretches over temporal intervals, and objects can be viewed as being temporally elongated entities. As such, a way of talking about objects persisting at different times must be developed. A central feature in this enterprise will be the notion of an object-stage which can be defined as follows:

> Object-stage $=_{df.}$ The material content of the space-time region occupied at a time.

An object's history, comprised out of a succession of object-stages, must fit together in some fashion or other. However, it is obvious that not just any succession of object-stages constitutes the history of a single persisting object.

Since not just any succession of stages will suffice, the task becomes one of trying to determine what the special relationship is between successive stages which do correspond to the history of a single object. Hence, the central problems of this dissertation can be delineated accordingly: when is a succession of object-stages, object-stages in the history of a single physical object?; and, under what conditions is a physical object which exists at one time the same object as (or, identical with) a physical object which exists at another time?

The attempt to give an analysis of our concept of persistence through time is plagued with difficulties. Since the concept to be defined is so fundamental, the problem of circularity constantly stalks the project. Moreover,this concept centrally touches many other complex metaphysical problems which must also be scrutinized to varying degrees.

My analysis of the persistence of physical objects is presented in Chapter IV. It turns out that the analysis is complex, a necessity when the broad range of results to be accounted for is recognized. This task is undertaken in Chapters II and III. In the former Chapter, I argue that prior to the construction of an analysis of persistence, we must recognize certain pre-theoretic "data" concerning objects and their persistence. Chapter II ponders a variety of cases, employing arguments to draw out

consequences which our analysis must account for. After Chapter II has delineated those results which must be incorporated in the analysis, Chapter III reviews various attempts to provide an account of persistence. However, it is argued that all such attempts fail to adequately account for the results set out in Chapter II.

Chapters V through VIII investigate a wide spectrum of issues in contemporary metaphysics checking to see how my analysis illuminates these problems. Chapters V and VI study the necessity of origins thesis. As a result of that study, a certain range of properties are specified as being original essential properties of an object. Chapter VII takes up the troublesome topic of transworld identity, closely associated with the problem of essentialism. A solution to this issue is suggested which utilizes my analysis of persistence and the views of many other philosophers. The final Chapter considers the debate over relative and absolute identity. It is demonstrated that my analysis of persistence is neutral with respect to this controversy, and in that Chapter my analysis is accommodated to either theory of identity.

The analysis presented in this dissertation is limited to our concept of persistence as it pertains to instances of bodies and artifacts. These would include such things as statues and cars, stones and pieces of gold or clay, watches and stereos. However, the analysis does not pertain to nonsubstantial items, or to such corporate items

as forests and nations. One notable limitation is that the analysis does not cover biological organisms, such as cats, dogs, and human beings.

Although there are these limitations to the analysis, the formulation presented is still far-ranging in its scope. Moreover, the insights uncovered throughout the course of this dissertation go toward construction of an analysis for the persistence of biological organisms, although that task is not undertaken within the confines of the current project.

This dissertation is, for the most part, ambitious which opens itself to a host of criticisms. At certain junctures, I indicate how a particular ramification of my analysis looks without spelling out the deep detail. However, in a metaphysical quest of this sort, one can only slay one dragon at a time; this I have done with my analysis of the persistence of physical objects.

CHAPTER II

PRE-THEORETIC CONSIDERATIONS

What phenomena and intuitions should a theory try to account for? Such questions about the adequacy criteria for a theory are oftentimes as difficult to answer as the theory is to construct. There are certain clearly recognized thorny problems which an analysis of persistence must adjudicate. Methodologically, there are two avenues such analyses might follow. On the one hand, one might construct such an analysis, without much attention to pre-theoretic features which one wants to account for, and then see how this analysis decides the answer to these dilemmas. On the other hand, one can first of all broadly indicate the results which the analysis ought to account for, the basis for such decisions being intuitions about certain core cases which bear directly upon these problems.

These two manners of constructing a theory arise when pondering the traditional problem of Hobbes' Ship of Theseus.[1] Suppose that someone has built a ship out of wood planks in January; call this Ship X. Over the next several months, a plank from X is removed and replaced by a different wood plank. At the end of this replacement procedure, in December let's suppose, all of the planks of X have been replaced; let us call this other ship in December Ship Z. However, suppose further that someone collects together all of the old planks from X, and in

December builds a ship exactly like X; let us call that Ship Y. The dilemma posed by the Ship of Theseus case revolves around an object's identity through time: is Ship X in January identical with Ship Y in December, or with Ship Z in December, or with both of them, or with neither of them?

As indicated above, it might be thought that one could formulate an analysis of persistence independently of any decisions on cases like the Ship case, thereafter stepping back to see how this analysis handles the Ship case. I will claim, however, that such a methodology is deficient when considering the problem of object persistence. This move is not possible because when one is putting together such an analysis, there are crucial decisions one must make which cannot be made independently of one's predispositions in the Ship case. For example, if one believes that all the parts of an object can be replaced while the object continues to persist, then one will probably believe that Ship X is identical with Ship Z. If, on the other hand, one believes that not all of the parts of an object can be replaced, then one will undoubtedly argue that Ship X is identical with Ship Y. But notice, these inclinations about what can and cannot occur in such part-replacement processes are assuredly pre-theoretic. This is not to say that one cannot produce arguments to support such inclinations, but one cannot look to the analyses of persistence for such arguments. Afterall, the analysis will subsume these inclinations and reflect them in the final formulation.

The foregoing discussion of methodology hopefully demonstrates that any analysis of persistence must first recognize certain pre-theoretic features which can then be incorporated into the analysis. In this Chapter, I set forth a variety of considerations which are of central importance for any analysis of persistence. Can all the parts of an object be gradually replaced? If not, where does one draw the line, if at all? If an object is disassembled and put back together, are there any restrictions on this "coming back together"? We can answer these questions without reliance upon any analysis of persistence. Indeed, as I have argued, we must first sketch answers to these questions, so that such answers can be carefully built into the edifice of our analysis.

(i) There are a number of cases concerning persistence where the desired result is obvious. If a statue is broken into many small pieces, certainly the statue no longer persists. However, if the statue only lost a small chip in falling off a shelf, wouldn't it be agreed that the statue still persists? Objects like statues, chairs, tables, which are characterized by count nouns, fail to persist when completely broken apart, although they do continue to persist if only a small part of their matter is removed. It will be seen shortly that this recognition is more problematic than might be thought.

(ii) Although objects are often characterized by count nouns, there are objects which are denoted by "counted mass nouns", such as 'piece of gold', 'lump of clay', 'ball of

wax', and the like. Certainly a lump of clay is every bit as much a physical object as a table or a chair. However, there are certain special features of "counted mass noun" objects which an analysis must be able to account for. Characteristically, such objects can undergo various structural transformations while remaining the same object. A lump of clay remains the same lump of clay as it is twisted into a multitude of shapes. When such a capability is appropriate, then, our analysis of persistence must allow for such structural changes.

(iii) Analyses of persistence are often plagued by cases in which a part is attached to an object. If a small trailer is attached to a car, the analysis of persistence must individuate the object "car" from the object "trailer." After such an addition, the same car still persists, but it just happens that a part has been attached to it. Likewise, the object "trailer" persists in the same fashion both before and after it is hooked up to the car. Once again, the analysis should carefully individuate the respective objects in such cases, and not rule that either object has gone out of existence.

(iv) An object can undergo a broad spectrum of qualitative changes which do not impinge upon the question of continued persistence. If a chair is painted a new color, we might remark that it looks like a new chair, but certainly our belief is that the same chair persists throughout the painting. However, suppose that the color of an object

is related to the object being made out of certain substances, such as a gold statue? If this statue became a new color, not by being painted but in virtue of the statue being composed out of a different type of substance, such a change could be significant with respect to the object's persistence. As to how it might be significant, upcoming discussions will tell the tale.

(v) An object can also undergo a variety of changes in its relational properties which do not rupture persistence. A car remains the self-same car whether it is parked in a garage or out of a garage. The statue on my desk would be the same statue if I moved it downstairs. In all cases of this type, such relational features of the object do not appear to have a direct impact upon an object's identity through time. Rather, such identity seems "internal" to the object and not connected to the object's relations to other objects. But is this the case for all such relational properties?

The preceding discussions (i)-(v) set forth certain cases of persisting objects which are fairly straightforward. Nonetheless, it is necessary to make explicit such features so that we are careful not to lose sight of all the phenomena to be incorporated.

The question to be discussed now is of central importance: can all of the parts of an object be gradually replaced while the object remains the same object? I will

present my answer to this question via the examination of certain cases.

(1) In the first case, Mr. P decides to gradually dismantle his stereo which now sits in the northwest corner of his apartment, and part by part reassemble the stereo in the southeast corner of the same room. Let us call the original stereo in the NW corner stereo X, and the reassembled stereo in the SE corner stereo Y. What is the relationship between X and Y? Certainly, we would all agree that X and Y are the same identical stereo which was gradually disassembled in one corner of the room, and gradually reassembled across the room. Nothing seems odd about the answer given in this case, since objects are disassembled and reassembled all of the time. We might also want to claim that the stereo did not exist during some interval when roughly X was half way disassembled and Y was half way assembled. However, this feature does not disrupt our belief that X is the same thing as Y.

(2) The second case closely resembles the first, except that Mr. P now decides that as he removes a part from X in the NW corner, he will both take the part to the SE corner and he will replace the part in X with another part. At the end of this gradual process, Mr. P has, as before, a stereo Y in the SE corner of the room. But he also has a stereo in the NW corner, call it stereo Z, which resulted from the replacement of X's gradually diminishing parts. The question now arises about X's relationship with Y and Z.

Is X identical with both, with neither, or with one of them but not the other?

It will be noticed that the genetic description of stereo Y in the SE corner in both cases is the same identical description. In case (1), a description of how stereo Y comes into existence will include the prominent fact that Y's parts are all of a certain type (also, they are X's original parts). It is this feature, that Y's parts are such and such certain pieces of substance, which seems most significant in Y's genetic description; of lesser significance are the temporal and spatial parameters of Y's coming into existence. In case (2), a description of how stereo Y comes into existence will be identical with the description of Y's appearance in case (1). The fact that there is the further feature of stereo Z being built in the second case does not impinge upon the description of how stereo Y comes into existence. What does this tell us about X's relationship with Y and Z?

There is a Principle which seems applicable in these cases. Wouldn't we want to say that any two objects are the same objects when they have the same origins? Of course, it becomes quickly obvious that we would not require the time and place of origin to be fixed in this rigorous fashion. What is crucial though is that the objects originate in the same pieces of substance or proper parts. In the case under consideration, stereo Y, in both case (1) and (2), originates in the pieces of X which are taken from the

dismantled stereo X. Consequently, isn't stereo Y exactly the same in both cases? Yes, given the Principle just sketched, they must have the same status. But what is the importance of this finding? Given the fact that we all agreed that stereo X was identical with stereo Y in case (1), why should we give a different answer in case (2)? There is no reason since it is now agreed that the relationship between X and Y is the same in both cases, given that Y's status is the same. Accordingly, it follows that stereo X cannot be identical with stereo Z in the second case.

Someone might dispute these conclusions on the following grounds. In all cases of object-part replacement, it might be argued, we look for the "most plausible counterpart" of the original object, which is then taken to be identical with the original object. According to this argument, stereo Y is the most plausible counterpart of stereo X in the first case. However, that is not so in the second case. On the contrary, stereo Z is the most plausible counterpart of X because Z is spatio-temporally continuous with stereo X. Hence, in the second case, we should say that X is not identical with Y but is identical with Z, although it is true that X is identical with Y in the first case.

Unfortunately, this line of argument leads to results which are counterintuitive. In the first case, we experienced no difficulty in conclusively stating that stereo

X is identical with stereo Y. But why should this clear decision be altered when the additional aspect found in the second case obtains? In both cases, a description of how stereo Y comes into existence would be exactly the same with respect to the origins of Y's parts (in X's original parts). Since we easily determine the question of identity in the first case, it is implausible to suggest that a different answer is a better answer in the second case. Given the same genetic descriptions of stereo Y in both cases, and Y's relationship to X, doesn't it make more sense to say that stereo Y is the most plausible counterpart to stereo X in both cases?

Once again, consider a proponent of the position outlined above, that in case (1) X = Y although in case (2) X = Z. In a new twist, however, suppose that stereo Y is not reassembled in case (2). This proponent believes, then, that X = Z in case (2) just when Y is not reassembled. Certainly the artificiality of this position is evident. This person seems to be saying that X = Z in case (2) just as long as no one correctly reassembles X's discarded parts into Y. But is it reasonable to say that X would no longer be identical with Z just as soon as someone reassembled Y? Suppose Y is reassembled but then destroyed shortly thereafter. The result would be that X was identical with Z, but then with Y, but then identical with Z again. This position does not appear very attractive for a number of reasons. It certainly gives us an odd picture of identity. If X = Z

and X = Y, wouldn't the transitivity of identity allow us to conclude that Y = Z? That is obviously preposterous, so this proponent might want to "temporalize" the account; but then what has happened to the original concept of identity? At any rate, I believe that these considerations suffice to show the inadequacy of such a position.

What are some consequences of someone believing that stereo X is identical with stereo Z (in all instances), but not with stereo Y, as I have argued? Suppose that Ms. Q, a friend of Mr. P's, endorsed such a view. While visiting P, Ms. Q notices his stereo (stereo X) which is five years old and offers to buy it. P agrees to a price, but on the condition that the stereo change possession in six months, a condition to which Ms. Q agrees. Shortly thereafter, Mr. P realizes that he will need a new stereo, but he also realizes that he cannot afford a new one immediately. So, gradually over the next few months, P buys a new part one day, a new one a few days later, and so on, until he has replaced all the old parts of stereo X with brand new parts (call this stereo Z). Later, he reassembles the old parts in the proper fashion (stereo Y).

At the end of six months, Ms. Q arrives to pick up her stereo. When informed of Mr. P's activities over the past few months, she is delighted because instead of the five year old stereo she thought she was getting (stereo X), she believes she is entitled to the new stereo (stereo Z), since on her view it is the same identical stereo as the one she

agreed to purchase. Would Mr. P be unreasonable to deny Ms. Q's claim, and give her the reassembled stereo of the old parts (stereo Y) in fulfillment of the agreement? I think not. Mr. P would point out to Ms. Q that they agreed on the sale of his five year old stereo, and the mere fact that the stereo had been dismantled for a period of time did not alter that agreement. Accordingly, Mr. P turns over stereo Y to Ms. Q.

In all of these cases we arrived at the same conclusion, that the original object is identical with the reassembled object. What is it about these reassembled objects which makes them identical with the original object in all cases? The common element is that the reassembled objects are made out of the same proper parts as the original object. These cases indicate that an important feature in object persistence is continuity of an object's proper parts. If that continuity is seriously ruptured, the object no longer persists. Consequently, this offers a clear answer to the question which initiated this discussion: can all the parts of an object be gradually replaced while the object continues to persist through such changes? No.

The foregoing discussion produced some significant results which an analysis of object persistence must accommodate. However, the results uncovered raise the following troublesome question: inasmuch as not all of the parts of an object can be replaced, how many parts can be replaced

without rupturing the object's persistence? The following two points bear directly upon this difficulty.

(a) It might be thought that, roughly speaking, an object must retain at least half of its original proper parts during any gradual part-replacement. Such a condition might be called a "majoritarian" requirement in that it is demanded that the majority of the object's original proper parts persist in order for the object to persist.

Unfortunately, there are obvious counterexamples to such a requirement.[2] Suppose someone changes the wrist band on their Timex watch. Do we think that this change has destroyed one watch and brought another into existence? Certainly not. The original watch continues to persist after a new band has been added. However, this type of majoritarian analysis would incorrectly handle this case. In the watch case, there has been a change in the "majority" of the object's proper parts with the removal and addition of the new band; and yet, this change has not destroyed the original object, as the analysis would incorrectly show.

The watch case seems to raise a thorny problem. Consider the case from another angle. Suppose that instead of replacing the band, the actual watch head is replaced, so that the old band is now added to a new watch head. According to the majoritarian analysis, the replacement of the watch head would not bring a new object into existence; afterall, since the band remains the same, the majority of the object's proper parts persist through the change.

However, we do think that such a change is significant. This change does destroy one object, and it brings another object into existence.

When looked at from both angles, the watch case leads to a startling conclusion: namely, some proper parts of an object are more important than others with regard to their being replaced and how this might bear upon the persistence of the total object. It appears as though the band of the watch, while being the major proper part in the quantitative sense, can be replaced without loss of persistence for the watch. On the other hand, when the smaller watch head is replaced, this seriously ruptures the persistence of the object, and the original watch goes out of existence.

The dilemma posed concerns how we will choose to accommodate two seemingly irreconcilable insights: from the stereo case, the insight that not all the parts of an object can be replaced; and from the watch case, the insight that sometimes most of the parts of an object can be replaced without loss of persistence. The resolution of this dilemma will occupy a good portion of Chapter III, in which I investigate other attempted analyses of persistence, and Chapter IV, wherein I present my analysis which successfully walks the tightrope between these two points.

(b) One obvious problem for any analysis which incorporates these pre-theoretic elements concerns the attempt

to pinpoint just when it is during the replacement process that the original object goes out of existence, and a new object comes into existence. This type of difficulty, in which it is demanded that a precise line be drawn which indicates when an object goes out of existence during a gradual process, closely parallels traditional sorites paradoxes. Consider certain vague predicates, such as 'is bald', or 'is short'. Certainly, these arguments run, someone four feet tall is short. But then someone one inch taller would still be short. As an inductive argument, this will eventually yield the result that someone seven feet tall is short, not a very satisfactory conclusion. Analogously, consider the chair sitting under me. Suppose we remove just one molecule from that chair. Certainly it would be agreed that it is still the same chair. Remove one more molecule, and one more, at each step asking the same question. Eventually, we will be forced to conclude that one molecule is the same chair as the original chair; again, not an acceptable conclusion.

What is important to realize about sorites cases and their intrusion into object persistence is that this is a problem <u>independent</u> of my views about object-part replacement. This problem will plague any approach to object persistence. Such a realization indicates just how deep this difficulty runs. Although there are a variety of ways to allegedly solve these paradoxes, none of them are too clearly successful. One must ask, from a metaphysical

perspective, are there any compelling reasons for drawing the line in one place rather than another? Nothing more can be said about this worry at present. It will be a concern which is taken up later.

The last point of discussion in this Chapter arises from cases in which objects are disassembled and later put back together. Consider the following two cases. In case (1), a stereo is floating around the universe with its parts held together by a magnetic force in a unique configuration. During some period of time, the magnetic force fails and the parts drift aimlessly. But suppose that the magnetic force is brought back. Assuming no other external forces, the parts of the stereo would come together in the same unique fashion. In case (2), suppose that the stereo is blown up with its parts scattered around the universe, while the magnetic force no longer operates. Suppose that somehow the parts are randomly brought back together in such a way that the original stereo is accidentally reassembled.

What differences are there between these two cases? In case (1), the stereo is put back together in a principled, systematic fashion by virtue of the magnetic attraction of the parts. Certainly, in such a case, we would agree that the original stereo is the same object as the reassembled stereo. However, in the second case, the situation was randomized so that it was pure luck that the parts came back into the correct configuration. In that case, it is

less clear that we would consider the original stereo identical with the accidentally reassembled stereo. But, I am not claiming that they are not the same object, only that it is less intuitive than in the first instance.

What features are central in determining these cases? A lot of it hinges upon our belief that the causal structures of systems are important. In other words, diachronic systems of persisting objects possess a causal structure into which the parts must fit. There is a principled regularity in accordance with which the parts form the same object. We need to know what sorts of things can transpire during these interims. Must there be some sort of regularity in the behavior which characterizes the way in which the parts come back together? In cases in which this regularity does not function, such disruption might be significant with respect to object persistence. However, as noted earlier, it is by no means clear that we would not want to consider the reassembled stereos the same objects as the original stereos in both cases. What is needed to decide this problem in favor of a causal requirement for any analysis of persistence is a case in which it is clear that a random, accidental reassembling of parts does not produce the same object that was disassembled. Such an example is presently lacking.

That completes the presentation of pre-theoretic elements of significance for any analysis of persistence.

As will be seen, not everyone agrees with these findings, and even fewer are able to accommodate the broad range of results generated from the stereo and watch cases, the sorites case, and the problem of a need for a causal requirement.

CHAPTER III

POSSIBLE THEORIES OF PERSISTENCE

The last Chapter presented a variety of results which a fully adequate analysis of the persistence of physical objects must account for. Some of these results are controversial, to be sure. Many philosophers believe that all parts of an object can be gradually replaced without loss of identity to the object. However, the last Chapter demonstrated the untenability of such a position. Hence, this result, along with the others laid out, represents a pre-theoretic set of data with which we can work.

In this Chapter, a spectrum of positions on persistence are presented. In some cases, an actual analysis offered by someone will be delineated; in other cases, I will offer an example of how a possible analysis might look using notions I develop. All of the analyses examined in this Chapter share a common feature: they fail as analyses of persistence. The point of this exercise, then, is to try to understand how and why these analyses fail, so that a better analysis can be formulated, a task undertaken in Chapter IV.

Perhaps the major issue surrounding persistence criteria is the extent to which considerations concerning the sort of object being traced or examined are relevant. An

analysis which claims that sortal terms, general terms like 'table', 'chair', 'car', are needed for tracing an object's life is called a sortal-relative analysis. An analysis which asserts that sortal-tracing is not needed when accounting for object persistence is called a sortal-neutral analysis. Given these two perspectives on object persistence, there are a variety of extreme and middle-of-the-road analyses which result from a mixing of these elements. The following schematic representation depicts these possibilities:

EXTREME		MIDDLE	EXTREME
Total sortal-relative	both, but relative dominant	both, but neutral dominant	Total sortal-neutral

The extremes are anchored by the total sortal-relativists and the total sortal-neutralists. In the ensuing discussion, I scrutinize all such positions, attempting to determine why these analyses fail.

Prior to presenting a total sortal-relativist analysis, a characterization of what a sortal term is must be given. The following definition, offered by E. Hirsch,[1] is similar to the definition given by D. Wiggins.[2] Hirsch writes:

> 'The general term F is a sortal' means: it is a conceptual truth (a rule of language) that any spatiotemporally and qualitatively continuous succession of F-stages corresponds to (what counts as) stages in the career of a single persisting F-thing.[3]

Accordingly, many typical nouns appear to be allowed by this definition; for example, 'tree', 'person', 'trunk',

'dog', 'mountain'. This characterization is too broad, however, because it allows less general terms, such as 'brown car', 'brown table', to count as sortals. If these less general sortals are not ruled out, they will play havoc with any attempt to give a sortal-relative account of object persistence.

Wiggins and Hirsch circumvent this problem via the notions of substance and phase sortals. The former are their primary interest, while the latter are less general sortals covering transitory "phases" in an object's life. Hirsch offers this:

> 'F is a substance sortal' means: F is a sortal, and it is a conceptual truth that if S is a continuous succession of F-stages, and S is not a segment of a longer continuous succession of F-stages, then the beginning and end of S correspond respectively to the coming into existence and going out of existence of an F-thing.[4]

Whether or not this definition works is an important, albeit somewhat tangential question. This definition doesn't seem to rule out the less general sortals it intended to rule out. Indeed, any sortal can be a substance sortal on this definition. This point aside, the notion of substance sortal has intuitive backing, which is sufficient for our purposes of analysing sortal-relative accounts.

(i) D. Wiggins appears to give an account of persistence which can be termed "total sortal-relativity." I believe, as does Hirsch, that Wiggins' statements imply that we can give no account of persistence in sortal-neutral

terms. This position is very strong; it implies that at the core, our concept of object persistence depends upon sortals, and we cannot even give an approximation of these criteria without appeal to sortals. Wiggins writes:

> ...there could not be any usable account of what it is, in general, to make a mistake or avoid a mistake in tracing (an object) a...To trace a I must know what a is.[5]

Accordingly, we cannot even frame a usable account of persistence criteria which are sortal-neutral.

Given such radical views on the role of sortals, an analysis utilizing this view can be given of persistence. Although the following characterization is not Wiggins', it does capture the essence of the total sortal-relativist:

(TSR) A succession S of object-stages, where S is the collection of stages $\langle s_1, s_2, \ldots, s_n \rangle$ are stages in the history of a single physical object if and only if:
(i) there exists a substance sortal T such that S is a succession of T-stages.

This analysis offers necessary and sufficient conditions for persistence *via* total sortal-relativity. All that is required by this analysis is that all stages in the succession be capable of being subsumed under the relevant substance sortal.

How successful is this analysis? One point that is striking in the extremeness of this view. Is it implausible to suggest, *contra* this view, that someone might be able to trace an object's career without any knowledge of the relevant sortal? I think not, although the point is

simply that sortal-neutral elements undoubtedly have some bearing upon what serves as persistence criteria. This objection aside, how well does the total sortal-relativist fare?

The total sortal-relativist cannot successfully handle the core cases presented in the last Chapter, such as the stereo and watch cases. The watch case cuts two ways. In one instance, only the band of the watch is replaced and it was claimed that the watch persisted through this change. (TSR) confirms this result, since all of the successive stages would be watch-stages. In the other instance, however, the watch head is replaced while the band remains, and the result seemed to be that the original watch goes out of existence after the replacement of the head. However, (TSR) does not produce that result. Once again, all of the stages would be watch-stages and consequently the object continues to persist. (TSR) is unable to differentiate between the replacement of significant proper parts in an object (e.g., the watch head) and those of insignificant proper parts (e.g., the wrist band).

Can (TSR) successfully handle the stereo case? Apparently not. The analysis would judge that all of the parts of an object can be replaced as long as the successive stages are all stereo-stages. In the stereo case, as the parts of stereo X are replaced resulting in stereo Z, all the stages are stereo-stages. Accordingly, (TSR) gives the

result that stereo X is identical with stereo Z, and not with stereo Y as Chapter II argued.

Wiggins would claim that his analysis' results on the stereo case are not upsetting. It is a featured aspect of the total sortal-relative analysis that all the parts of an object can be replaced over time. So, it is not surprising that this judgment would be affirmed in the stereo case. He might reply "we have different intuitions on the matter, and that's all there is to it." This is partially true since there are intuitive differences on this topic. However, in the last Chapter, I presented arguments which supported my position, arguments which seem quite convincing.

One advantage of Wiggins' position is the simplicity of such an analysis. As will be seen, if one accepts my position that all parts cannot be replaced, the analysis for this can be quite complicated. Wiggins' analysis is elegant and to the point. Even given this feature of simplicity, I am not compelled to join the total sortal-relativists. Why? Because of the convincing nature of the arguments I presented which show that all parts of an object cannot be replaced.

The above investigation has determined that the total sortal-relativist's position is untenable. Although there are attractions to such a position, these are not sufficient to tip the balance in favor of such a position.

(ii) A more reasonable posture is offered by E. Hirsch. Although sortal-relative conditions are dominant in his final analysis, Hirsch believes that sortal-neutral elements are important and cannot be excluded from the analysis. His analysis is one of the more prominent attempts to spell out an analysis in detail, and it is worthwhile to set out the highpoints of his position and evaluate his success.

Hirsch vehemently disagrees with the total sortal-relativists. At the very core of our concept of persistence, he believes certain sortal-neutral elements are important. Hirsch's analysis reads:

(H) A succession $\underline{S}$ of object-stages, where $\underline{S}$ is the collection of stages $\langle s_1, s_2, \ldots, s_n \rangle$ are stages in the history of a single physical object if and only if: (i) $\underline{S}$ is spatiotemporally continuous; and (ii) $\underline{S}$ is qualitatively continuous; and (iii) there is a substance sortal $\underline{T}$ such that $\underline{S}$ is a succession of $\underline{T}$-stages.[6]

Conditions (i) and (ii) present sortal-neutral strictures. Hirsch understands these conditions in the following manner:

> We may define a space-time path as a series of place-times, i.e., a series of ordered pairs (p,t) where $\underline{p}$ is a region of space and $\underline{t}$ is a moment of time. To say that the space-time path $\underline{P}$ is spatiotemporally continuous means that where $(\underline{p},\underline{t})$ and $(\underline{p}',\underline{t}')$ are place-times in $\underline{P}$ then if $\underline{t}$ is very close to $\underline{t}'$, $\underline{p}$ is very close to $\underline{p}'$. And to say that $\underline{P}$ is qualitatively continuous means that where $(\underline{p},\underline{t})$ and $(\underline{p}',\underline{t}')$ are placetimes in $\underline{P}$ then if $\underline{t}$ is very close to $\underline{t}'$, the object which occupies $\underline{p}$ at $\underline{t}$ exemplifies qualities at $\underline{t}$ which are very similar to the qualities exemplified at $\underline{t}'$ by the object which occupies $\underline{p}'$ at $\underline{t}'$.[7]

According to Hirsch's analysis, the persistence of object Ø is to be understood in terms of a spatiotemporally and qualitatively continuous succession of Ø-stages.

Although Hirsch packs both sortal-neutral and sortal-relative conditions into his analysis, there is no mistaking which elements are dominant: the sortal-relative ones. Is Hirsch any more successful than the total relativist in the handling of the stereo and watch cases? It seems not. In fact, Hirsch's sortal-neutral elements get him further into trouble.

Consider again the two-sided watch case. In the case in which the watch head is replaced but not the band, Hirsch's analysis rules that the object continues to persist, or so it appears. Certainly conditions (i) and (iii) of (H) are satisfied. Moreover, it appears that (ii) is also satisfied, since Hirsch interprets "qualitative continuity" in a very weak sense:

> We must interpret the condition of qualitative continuity...as requiring continuity only in the weak sense. According to the analysis, then, a necessary condition for a succession S of object-stages to correspond to the career of an object is that any object-stage in S should be very similar to some temporally neighboring object-stage in S. This weak requirement of continuity is exceedingly vague, as vague as the idea of two qualitative states being 'very similar' to each other.[8]

The two object-stages before and after the watch head is replaced, could be considered very similar qualitatively, especially if we imagine the watch head being very small and

the band quite large. Of course, given the vagueness of Hirsch's depiction, he could claim that the qualitative continuity is ruptured. If that claim is made, however, he is trapped by the other side of the watch case in which only the band is replaced. In that case, certainly the respective stages are not qualitatively similar, and yet we adjudged that the watch continues to persist. So, regardless of the interpretation of condition (ii) in (H), Hirsch's analysis runs afoul of the watch case.

It is quite easy to see that Hirsch's analysis gives the wrong result in the stereo case. Given the dominance of the sortal-relative condition (iii), Hirsch's analysis will decide that stereo X is identical with stereo Z because there is a spatiotemporally and qualitatively continuous succession of stereo-stages from X to Z. As Hirsch states:

> ...an object may retain its identity through a drastic or even total alteration of its parts, so long as this alteration takes place by a continuous sequence of small changes, each small change leaving the object with a major portion of the similarly arranged parts that it had prior to the change.[9]

It is just this stance which Chapter II disputed through the examination of the stereo case. Hirsch offers this assessment as a consequence of his analysis. However, it is not implausible to suggest that this position needs to be independently argued for, just as I independently argued for the opposite conclusion in the last Chapter. My methodology implies that one must first make a decision

about the question of whether all the parts of an object can be replaced. If one arrives at the conclusion that parts can be fully replaced, then one will opt for a version of a sortal-relative analysis. On the other hand, if one concludes as I did, one will be pushed towards an analysis which accounts for these facts.

It might be argued, against my methodological claim, that one can argue for a sortal-relative analysis on grounds having nothing to do with the question of parts-replacement. One consequence of adopting such a position will turn out to be that all parts of an object can be gradually replaced. But this is not so. Analyses of object persistence are checked for adequacy against traditional problems, such as the Ship of Theseus. One analysis is judged more adequate than another because it gives answers which square with some set of pre-theoretic data. Consequently, we must make every effort to clarify the nature of such data prior to theory construction.

Although Hirsch's analysis goes beyond Wiggins', it is no more successful. Why? Because in any analysis in which sortals straightforwardly play a dominant role, such analyses will be unable to handle core cases like the watch and stereo cases. The question now centers around whether sortal-neutralists are any more successful.

(iii) The next possible position to be studied might best be called the "pure middle position." Such an analysis

would have an equal dependence upon both sortal- relative and neutral conditions, without either one being more dominant than the other.

In all likelihood, this pure position is impossible to hold. As the preceding discussions have indicated, one must choose at crucial junctures between the dominance of sortal-relative or neutral conditions. How would it be possible to remain unbiased on this question when considering the Ship of Theseus? One possible position might rule that whenever the sortal-relative conditions clash with the sortal-neutral conditions, or vice versa, the object no longer persists. In other words, only when all conditions of the analysis agree that the object continues to persist does an object actually continue to persist. This position, however, is obviously unsatisfactory. In the stereo case, we would obtain the result that the original stereo X was not identical with either stereo Y or with stereo Z.

This brief perusal of the pure middle position indicates that an analysis must choose between sortal-relative or neutral conditions for certain cases. This choice will determine how controversial cases are adjudicated. To refuse to choose one answer over the other, as the pure middle position actually does, does not provide a viable option for an adequate analysis of persistence.

(iv) In the next two sections, analyses which place primary emphasis on sortal-neutral conditions will be investigated. Just as there is the total sortal-relativist,

so too is there the total sortal-neutralist. Such a person believes that an analysis of persistence can be framed without any reference whatsoever to sortals. Such a person might choose this position because of a belief that language considerations have no place in the metaphysical determination of the persistence of objects.

Once again using Hirsch's notions, we can frame the analysis of the total sortal-neutralist:

(TSN) A succession $\underline{S}$ of object-stages, where $\underline{S}$ is the collection of stages $\langle s_1, s_2, \ldots, s_n \rangle$ are stages in the history of a single physical object if and only if:
(i) $\underline{S}$ is spatiotemporally continuous; and
(ii) $\underline{S}$ is qualitatively continuous; and
(iii) $\underline{S}$ minimizes change (discounting mere change of location).

Just what does condition (iii) amount to? Presumably, a succession $\underline{S}$ minimizes change if, approximately, any divergence from $\underline{S}$ would involve more change than $\underline{S}$ does. Hirsch, in discussing this type of requirement, asserts that condition (iii) can be phrased more strictly:

(iii') For any succession $\underline{S}'$, if $\underline{S}$ and $\underline{S}'$ partly coincide and partly diverge and $\underline{t}$ is their time of divergence, then object-stages in $\underline{S}$ at times very close to $\underline{t}$ are more similar to each other than are object-stages in $\underline{S}'$ at times very close to $\underline{t}$ (discounting mere locational similarity).[10]

As such, we will take the sortal-neutral conditions (i) - (iii') as presenting the necessary and sufficient conditions for object persistence.

Is the total sortal-neutralist any more successful with (TSN) than the total sortal-relativist was? No. Consider the case in which a gold statue is melted down into a solid gold ball. (TSN) would rule that the statue persists in the melted down ball because it is possible to trace a continuous and change-minimizing path from the original gold statue to the solid gold ball. The analysis possesses such limitations. However, (TSN) can handle routine cases where objects are broken into many pieces. Nonetheless, the analysis falls short on cases where an object goes out of existence by turning into another object with similar compositional properties, as the statue case pinpointed.

How does this extreme sortal-neutral analysis handle the stereo case? Such a case brings out another weakness of (TSN). The analysis is too vague because it will not clearly guide us in choosing which of the paths diverging from the original stereo is to be treated as minimizing change. It might be claimed that the continuous path traced from stereo X to Z minimizes change in one manner since the path is spatiotemporally continuous, while the discontinuous path traced from stereo X to Y minimizes change since the same matter constitutes both X and Y. Of course, one reply is that the analysis can be refined in such a way to rule out this problem. This could be accomplished either by stipulating that a spatiotemporally

continuous path takes precedence over a discontinuous path, or by stipulating that continuity of original matter takes precedence over considerations about spatiotemporal continuity. With the addition of independent arguments these provisos could be inserted into the analysis. But, such restrictions will still not enable the analysis to correctly adjudicate the statue case. In that case, there is continuity of original matter and there is spatiotemporal continuity; it cuts both ways.

There are other instances which cause great trouble for the total sortal-neutralist. However, the foregoing examination sufficiently shows that such an analysis cannot be made to work, regardless of the number of provisos attached. What conclusions can be drawn from this failure? Just as the failure of the total sortal-relativist brought out the need for some sortal-neutral considerations, so too the collapse of the total sortal-neutralist points to the necessity of including sortal-relative conditions in the final analysis.

(v) The last position to be examined contains both sortal-neutral and relative elements. However, unlike the position considered under (ii), this analysis places a premium on sortal-neutral conditions. Simply put, one might say that this position places a greater emphasis on the object's continuity of proper parts (or matter) than on the object's spatiotemporally continuous path. Such an

analysis has learned a lesson from cases like the stereo case. The pertinent question, however, will revolve around how this analysis handles the watch case.

In all of the previous analyses, the only requirement in terms of continuity of proper parts concerned "local continuity." That is, in a succession of object-stages, these analyses only demanded that there be continuity of proper parts within a small temporal interval in the succession. This guaranteed that there would never be gross changes in the object's compositional status from one moment to the next. However, it can be seen that this local requirement is not strong enough; it will countenance a complete replacement of an object's parts when done over a long period of time. The point of the stereo case is just that this cannot be done. Consequently, the analysis now under scrutiny requires "global continuity"; that is, we now demand that an object retain most of its proper parts throughout its life, rather than over small intervals as before.

Such an analysis can be framed from elements already introduced:

(*) A succession $\underline{S}$ of object-stages, where $\underline{S}$ is the collection of object-stages $\langle s_1, s_2, \ldots, s_n \rangle$ are stages in the history of a single physical object if and only if:
(i) $\underline{S}$ is spatiotemporally continuous; and
(ii) $\underline{S}$ is qualitatively continuous; and
(iii) $\underline{S}$ minimizes change; and
(iv) there is a substance sortal term $\underline{T}$ such that $\underline{S}$ is a succession of $\underline{T}$-stages; and
(v) $\underline{s}_1$ is qualitatively similar to $\underline{s}_n$.

Conditions (i)-(iii) are simply those of the total sortal-neutralist. However, that extremism has been tempered by the addition of a sortal-relative condition (iv). This condition will rule out the statue case which plagued the total neutralist. If a gold statue is melted down into a gold ball, the ball-stages will not be statue-stages. Accordingly, (*) will rule them out as part of the same persisting statue.

What makes this analysis contain sortal-neutral elements which are dominant? The last condition (v), which might be stated in many forms, allows this analysis to correctly rule on the stereo case. Consider the continuous path from stereo X to stereo Z, where Z has no proper parts in common with X. The sortal-relative analyses ruled that X is identical with Z, a result I disputed. Now, condition (v) of (*) rules out this identity claim of X with Z. Why? Because a stereo X-stage will be qualitatively dissimilar with a stereo Z-stage. Of course, this will only follow if "qualitatively similar" is understood in the following specific manner: namely, two stages are qualitatively similar if they are compositionally similar and if they share the majority of the same proper parts. On this rendering, condition (v) rules out X's being identical with stereo Z.

Does this analysis (*) rule that stereo X is identical with the rebuilt stereo Y? Yes, with certain modifications.

The analysis will yield the conclusion that stereo X goes out of existence at some point, approximately after half of its proper parts have been removed. From this analysis we need to construct a set of conditions which will tell us when an object which has been disassembled is identical with an object which comes (back) into existence at a later time. Without doing such a chore, one obvious requirement will be that the original object's proper parts be the same proper parts as the parts of the new or reassembled object. Clearly, this requirement will be satisfied by stereo X and Y. Hence, it appears as though (*) will adequately handle the statue case and the stereo case.

Does this success imply that the analysis presents both necessary and sufficient conditions for object persistence? Although close, the answer must be negative, for an examination of the watch case indicates that the current analysis fails to provide the desired answer. In the case in which only the band is replaced, the analysis would give the wrong answer that the object goes out of existence. It must give this answer since over "half" of the original object's proper parts have been replaced. On the other side of the watch case, where the watch head is replaced, the analysis again gives the wrong conclusion. The replacement of the watch head need not disrupt the continuity of the object's majority of proper parts. So, the analysis

(*) will yield the incorrect result that the watch continues to persist.

Although this last analysis overall had more success than any of the others, it too ultimately fell short. Must we conclude, then, that there is no adequate analysis of object persistence? Certainly not. As originally stated in Chapter II, the dilemma now posed concerns how we will accommodate two seemingly irreconcilable insights: from the stereo case, the insight that not all the parts of an object can be replaced, and from the watch case, the insight that sometimes most of the parts of an object can be replaced. The sortal-neutral analyses could handle the former but not the latter, while the sortal-relative analyses had less success in general.

The resolution of this dilemma arises through the introduction of notions which themselves incorporate both sortal-neutral and relative considerations. The multiplicity of analyses just examined fail because they only place such considerations "side by side." What is needed is a total fusion of such elements into a more comprehensive analysis. In the next Chapter, I present my analysis of persistence which picks up the pieces from this Chapter and recombines them in a novel fashion.

CHAPTER IV

MY THEORY OF PERSISTENCE

In this Chapter, my analysis of the persistence of physical objects is formulated. The Chapter can generally be divided into three parts: (I) in the first part, a variety of preliminary notions are defined. Some are straightforwardly sortal-neutral, others sortal-relative. Near the end of this section two central notions are defined which integrate both sortal-relative and sortal-neutral considerations; (II) the important project of this Chapter is accomplished in this section wherein my two-step analysis of persistence is defined; (III) finally, my analysis is checked against some problematic cases in order to determine how successful the analysis is.

I

The first straightforward sortal-neutral notion presents a compositional criterion for object-stage interaction. This diachronic relation, called connectedness, can be defined as such:

D4.1 $Con((X,t),(Y,t'))=_{df.}$ Object-stage X at time t is connected in some proportion to object-stage Y at time t' if and only if stages X at t and Y at t' share the same proper parts, in some proportion.

It will immediately be noted that stage-connectedness is a notion of degrees. Accordingly, stages can be connected to a greater degree, if they share more proper parts than

not, or to a lesser degree, if they do not share more proper parts than not.

The relation of stage-connectedness is symmetric, although strictly speaking it is not transitive. That is, the degree or proportion of connectedness is not transitive across successive object-stages. If stage A at t_1 is connected in proportion 80% with stage B at t_2, that is, they share 80% of the same proper parts, and stage B at t_2 is connected in proportion 40% to stage C at t_3, it does not follow that stage A at t_1 is connected in proportion 80% to stage C at t_3, or even that stage A at t_1 is connected in proportion 40% to stage C at t_3. However, there is an important sense in which stage-connectedness is "transferred" from stage to stage. Hence, it would be proper to claim that stage A at t_1 is connected in some proportion, providing that stages A and C did share some proper parts.

This definition of connectedness presupposes the ability to identify micro-physical constituents over time. Some might say that this simply pushes the problem of identity from the macro-level of constituted objects, to the micro-level of the constituents of such objects. There is some truth in this claim. However, since my interest is with the persistence of these constituted objects, I must presuppose this ability to trace micro-physical constituents through space-time. Such an ability is by no means unproblematic. This ability is often carried out within special relativity, and even within general

relativity, via the notions of a genidentical class of events and of a causal chain connecting two such events. However, it has been pointed out by Lawrence Sklar[1] that these notions appear to fall apart on a quantum-theoretic view of the world. So, while there are difficulties surrounding this presupposition, it is made in order to examine the problem of the persistence of constituted physical objects.

What are some examples of object-stage connectedness? Consider the following three cases. (1) Suppose there is a gold statue at $\underline{t}_1$ (stage U) which continues to exist at $\underline{t}_5$ (stage V). In such a case, where the statue might simply be sitting on my desk, are the object-stages connected? Yes, certainly stage U at $\underline{t}_1$ is connected with V at $\underline{t}_5$. Moreover, their proportion of connectedness would be extremely high since the statue did not change compositionally from $\underline{t}_1$ to $\underline{t}_5$. (2) Suppose that we have a gold statue existing at $\underline{t}_1$ (stage U), but that I melt down the statue at $\underline{t}_3$, so that at $\underline{t}_5$ I have a solid ball of melted down gold (stage V). Once again, it is clear that the stage at $\underline{t}_1$ is connected to the stage at $\underline{t}_5$ since there has been no compositional change, assuming that no gold was lost during the melting process. (3) Suppose that I have the melted down gold ball before me at $\underline{t}_5$ (stage V). However, I decide to break the ball into three smaller gold balls of the same size at $\underline{t}_7$; so, at $\underline{t}_9$ I have three solid gold balls before me (stages W,X,Y). What is the relation between V at $\underline{t}_5$, and stage W

at t_9, X at t_9, and Y at t_9? In all three instances, the stages are connected in some proportion. Moreover, if we continued to break the gold balls into more gold balls, the new stages of the balls would continue to be connected with successive stages, in varying degrees. Clearly, the proportion of connectedness between stages V at t_5 and W at t_9, for example, would be less than the proportion of connectedness exhibited in cases (1) and (2). This is expected, given the compositional criterion of connectedness, because in this last case there has been a substantial compositional change from stage V at t_5 to stage W at t_9.

The other sortal-neutral notion, called diachronic linkage, is more restrictive and regulates the proportion of connectedness between stages so that this proportion never dips "below 50%." Broadly speaking, this relation could be called "majoritarian" since it requires that there be continuity of the majority of the proper parts from stage to stage. A central element in diachronic linkage is "degree of connectedness" which is defined as follows:

D4.2 $degCon((X,t),(Y,t'))=_{df}$. The degree or proportion to which the proper parts of stage X at t intersect or overlap with the proper parts of stage Y at t'.

Given this notion, we can define diachronic linkage:

D4.3 $D1((X,t),(Y,t'))=_{df}$. Object-stage X at time t is diachronically linked in some proportion to object-stage Y at time t' if and only if:
(i) $Con((X,t),(Y,t'))$ &
(ii) $\sim(\exists$ stage Z at t'$)\{Con((X,t),(Z,t'))$ &
$[degCon((X,t),(Z,t'))\geq degCon((X,t),(Y,t'))]$
& $\sim Con((U,t'),(Z,t'))\}$.

What exactly does this characterization assert? Two stages, X at t and Y at t', are diachronically linked just in case the stages are connected; and at the later time t', there does not exist a stage Z whose degree of connectedness with X at t is greater than or equal to that of Y at t' with X at t, where Z at t' is not connected with Y at t'. These conditions are intended to disqualify instances of significant fission, where a major portion of an object breaks off or is replaced. This requirement will guarantee a continuity of the majority of proper parts from successive stage to stage, unlike the less restrictive relation of connectedness.

One troubling feature of diachronic linkage concerns an air of "arbitrariness" which appears to enshroud this notion. It might be objected, "why set 50% as the point at which diachronic linkage fails to hold?" Of course, this is a piercing question, not because there is no reasonable answer to it, but because it points to a fundamental feature in the concept of "persistence." First of all, there is no good reason to set the figure at 50% rather than 55% or 60%. What does seem clear from the methodological considerations laid out in Chapter II via the stereo and watch cases is that there is some such terminal point since an object cannot have all of its parts removed or replaced.

A belief shared by most is that the concept of persistence is generally imprecise and unspecifiable. Paraphrasing David Lewis,[2] one could say that this does not mean that we cannot give a clear account of the necessary and

sufficient conditions of object persistence. It means that such an account must either be presented in vague terms--which does not mean ill-understood terms--or be made relative to some parameter that is fixed only within rough limits in any given instance. My analysis of persistence uses certain imperfectly fixed parameters which, I believe, carry great intuitive backing and which will not cause undue complications except where they must occur. Hence, although 50% is in some sense set as the cut-off point in the definition of diachronic linkage, this feature can and will be further relativized shortly through the notion of a "significant proper part" of an object. As such, then, this figure is not meant to regulate in a strict and precise fashion; on the contrary, certain circumstances in a given instance might very well raise or lower this figure, as will be demonstrated shortly.

What sorts of actual cases are excluded by this relation? Recall the three cases considered earlier. (1) In this case, in which a gold statue simply sits on my desk, the stages of the statue are diachronically linked at $\underline{t}_1$ with $\underline{t}_5$. (2) In the second case, in which the gold statue is melted down into a solid gold ball, the statue-stages are diachronically linked with the later ball-stages. This follows since diachronic linkage only requires significant overlap of proper parts from stage to stage. (3) In the third case, however, the gold ball at $\underline{t}_5$ is broken down into three smaller gold balls at $\underline{t}_9$ of the same size. The

respective stages at $\underline{t}_9$ would be connected with the ball-stage at $\underline{t}_5$, but they would not be diachronically linked. Why? Because condition (ii) of D4.3 is violated.

Specifically, we could ask if stage $\underline{V}$ at $\underline{t}_3$ is diachronically linked with stage $\underline{X}$ at $\underline{t}_9$? At time $\underline{t}'$ (i.e., $\underline{t}_9$) there exists a stage $\underline{Z}$ (i.e., stage $\underline{W}$), one of the ball-stages, which is connected with $\underline{X}$ at $\underline{t}$ (i.e., $\underline{V}$ at $\underline{t}_3$) and whose degree of connectedness is the same as that of $\underline{X}$ at $\underline{t}$ with $\underline{Y}$ at $\underline{t}'$ (i.e., stage $\underline{X}$ at $\underline{t}_9$), where $\underline{Y}$ at $\underline{t}'$ and $\underline{Z}$ at $\underline{t}'$ are not connected. This is a violation of condition (ii) of the definition. The degree of connectedness in this case got too low and correspondingly is ruled out by D4.3. This indicates that diachronic linkage will only allow cases of fission in which the fissioned-part of the object is overall an insignificant part of the whole object. The gold ball could have lost a small chip, but it cannot be broken up into several other gold balls without violating D4.3.

In the preceding discussion, straightforward sortal-neutral notions were introduced. Although such notions will not directly be used to formulate persistence criteria, they will be employed in further definitions. What is also needed, however, are certain sortal-relative notions which will be relied upon in the final analysis.

What is a sortal term? From the discussion offered in the last Chapter, it is obvious that sortals are general terms of language which can be used to characterize broad

classes of entities. But what is equally clear is that not every general term is such that it can be used to describe the history of a persisting object of a certain sort. Some terms, such as 'red' or 'short', are "general" in that they can be predicated of a number and variety of entities. Yet, these terms do not appear to be the brand of general terms of interest for object persistence.

Utilizing some of the elements just introduced, the following definition of a sortal is offered:

D4.4 A general term T is a sortal if and only if it is a conceptual truth (or a rule of language) that any diachronically linked succession of T-stages corresponds to stages in the history of a single persisting T-thing.

Our interest in sortal terms derives from our belief that an object's history can be continually traced under such terms. For example, if an object is a table at all times during its existence, or a car, or a chair, we believe that a single object persists throughout the tracing of such a continuous path. Such terms will be considered sortals under D4.4.

On the other hand, the following problem arises with the above definition. While 'table' is a sortal term, so too is 'red table', 'yellow table', 'brown table', and the like. Suppose that we have a brown table which is then painted red. Correspondingly, the career of that object would be traceable under two different sortals, 'brown table' and then 'red table.' However, we do not believe that the

table goes out of existence when it is painted red. This change of color does not alter the metaphysical status of the object as a continuous persisting table-thing. Furthermore, unless we can more carefully circumscribe the sortals we are interested in, any attempt to utilize sortal terms in an analysis of persistence will be plagued in just this fashion.

We want just those sortals which correspond to entire histories of persisting objects. The above discussion indicates, however, that an object can pass through various transitory phases which can be traced under less general sortals, such as 'car-in-the-garage', 'red table', and the like. These less general sortals must be set aside or else they will play havoc with any attempt to explicate object persistence. This difficulty can be avoided by introducing the notion of a maximal sortal.

D4.5 A general term $\underline{T}$ is a maximal sortal if and only if:
(i) $\underline{T}$ is a sortal term &
(ii) $\sim$ ($\exists$ sortal T') such that $\underline{T} \subset \underline{T}'$.

This definition asserts that $\underline{T}$ is a maximal sortal just in case $\underline{T}$ is a sortal, and it is not the case that there is another sortal $\underline{T}'$ such that $\underline{T}$ is properly included in $\underline{T}'$.

Any controversy over D4.5 will center upon the notion of "proper inclusion." Under what conditions is term $\underline{T}$ properly included in term $\underline{T}'$? Just when it is necessary that if anything is a $\underline{T}$-thing, it is also a $\underline{T}'$-thing, i.e., $\underline{T} \subset \underline{T}'$ iff $\Box(x)\ [(\underline{T}x \rightarrow \underline{T}'x)\ \&\ \underline{T} \neq \underline{T}']$. How does the notion of a maximal sortal rule out those less general sortals?

Take the case of the brown and red table. The term 'brown table' is not a maximal sortal because it fails condition (ii) of D4.5. That is, there is a sortal T', namely 'table', such that 'brown table' is properly included in 'table', since anything which is a brown table is necessarily a table also.

To solidify D4.5, one should articulate a position on property inclusion. Under what conditions are the properties of certain objects properly included in the properties of other objects? Also, what type of necessity is involved here? It is my present intention to remain neutral on the choice of an analysis of property inclusion since I am reasonably certain that the explanation offered adequately indicates how maximal sortals function. The adoption of one analysis over the other, in this case, would not have far-reaching consequences. Along the same line, it doesn't appear to matter if one interprets the necessity operator as "metaphysically necessary that" or "physically necessary that", since the adoption of one over the other would not change the interpretation greatly.

One seeming defect of D4.5 concerns the ability of general terms like 'piece of matter' or 'physical object' to properly include all the sortals we are interested in. However, since it is generally reasoned that these terms are not sortal terms, they would be excluded by condition (i) of D4.5. It should be obvious, at any rate, that even if these terms did obstruct the notion of a maximal sortal,

they could be ruled out in some fashion. Maximal sortals are going to be used centrally in the analysis of persistence. It will be argued that object's histories must be traceable under maximal sortals.

This concludes the introduction of straightforward sortal-neutral notions, such as connectedness and diachronic linkage, and sortal-relative notions, such as maximal sortals. As the last Chapter pinpointed so forcefully, any analysis of persistence which employed notions of this general kind cannot handle the variety of cases considered, such as the stereo case.

The end of Chapter III argued that the multiplicity of analyses examined failed because they only place such notions "side by side." What is needed is a total fusion of such elements into a more comprehensive analysis. Towards this end, two important notions will be introduced: that of a significant proper part, and that of full diachronic linkage.

The impetus for the notion of a significant proper part comes from reflection on the watch case. What are the salient features of that case which cause such problems for analyses of persistence? Presumably, the problem lies in the wrist band of the watch not being significant to the overall object, since its removal and replacement does not rupture persistence. On the other hand, the watch head, although not quantitatively important to the watch-object, is significant with respect to the persistence of the watch.

When the head is replaced, the object goes out of existence; in a sense, the identity of the watch seems to reside "in the watch head." This insight needs to be captured in an analysis of persistence. But it cannot be accomplished by a piecemeal attempt to designate certain parts of an object more significant than others on a case by case basis. Indeed, it seems that the significance of the watch head is intimately tied to the maximal sortal 'watch.' Isn't it reasonable to expect that this would be so for other maximal sortals? If so, the following definition arises:

D4.6 $P(x) =_{df.}$ {$\underline{y}$ | $\underline{y}$ is a proper part of stage $\underline{x}$ & ($\forall$ maximal sortal $\underline{T}$) $\underline{T}x \rightarrow \sim\underline{T}(\underline{x}\backslash\underline{y})$}.

This definition asserts that a proper part $\underline{y}$ of an object-stage $\underline{x}$ is significant just when, for the maximal sortal such that $\underline{x}$ is a $\underline{T}$-stage, stage $\underline{x}$ <u>without</u> part $\underline{Y}$ no longer falls under term $\underline{T}$.

In the watch case, the watch head is a significant proper part while the wrist band is not; definition D4.6 affirms this fact. It will be noticed that for many maximal sortals, such as 'lump of', the notion of a significant proper part will be entirely quantitative, although this is clearly not so in the watch case. Furthermore, it must be admitted that for many maximal sortals, just what constitutes a significant proper part is open to question. What is a significant proper part of a car? The engine? The engine with the chassis? The frame? Indeed, such

decisions are problematic, although presumably one can opt for the quantitative interpretation in cases where a proper part is not obviously more significant than others.

The other notion to be introduced is that of full diachronic linkage. This notion further extends the integration of sortal-neutral and relative elements, and it differs importantly from the notion of (simple) diachronic linkage. Given the idea of a significant proper part, we want to require the compositional continuity of the significant proper parts from stage to stage. Furthermore, we demand that this requirement be fulfilled recursively. The following watch case indicates how this recursiveness functions. After determining the watch's significant proper part(s), namely the 'watch head', we monitor the identity of the watch head from stage to stage. But on what does the continued identity of the watch head depend? The watch head's significant proper parts must retain their identity from stage to stage. Accordingly, the analysis "descends" from the macro-level of the watch, through the levels of significant proper parts, requiring that there be identity of such proper parts. Ultimately, the analysis (the base clause in a recursive definition) will reach the level of basic constituents, where we demand that such constituents maintain their identity through successive stages. This monitoring, as might be guessed, will be regulated by the most explanatory physical theory available.

It will be recalled that this ability was presupposed earlier in the definition of stage-connectedness.

An extremely important realization is that the significant proper parts, such as the watch head, *can* undergo *some* change as long as two conditions are fulfilled: one, the part continues to fall under the same maximal sortal, *and* two, not all of the parts of the significant proper part are changed. In past formulations of the second requirement, 50% has been chosen as the "cut-off" point for the amount of change possible. However, this is now modified in the following important manner. A significant proper part *A* can have all of its *in*significant proper parts changed; but *A*'s significant proper parts cannot be completely replaced, no matter how gradually. But how much change can these significant proper parts of *A* undergo? This cutoff point, instead of being arbitrarily set at 50%, will now be allowed to vary given the sortal in question. No sortal will allow total part-replacement, but some sortals might allow more than 50% change, while other sortals will allow less than 50% alteration. This recalibration should be understood as being inserted into the analysis.

We require that significant proper parts be related in the following fashion from stage to stage. This relationship is called *diachronic inclusion*:

D4.7 $\underline{s} \subset_D \underline{s'}_{t'}$ if and only if $(\forall x)$ [(x is a significant proper part of s_t) $\rightarrow$ $((\exists x')(x'$ is a significant proper part of $s'_{t'})$ & $Dl(s(x,t),s'(x',t'))$)].

This definition asserts that stage $\underline{s}$ at $\underline{t}$ is diachronically included in stage $\underline{s}'$ at $\underline{t}'$ just when, for all proper parts $\underline{x}$, if $\underline{x}$ is a significant proper part of stage $\underline{s}_t$, then there exists an $\underline{x}'$, such that $\underline{x}'$ is a significant proper part of $\underline{s}'_{t'}$, and the stage of $\underline{x}$ at $\underline{t}$ is diachronically linked with the stage of $\underline{x}'$ at $\underline{t}'$ (where diachronic linkage is now understood in the fashion just indicated, as depending upon the sortal in question which regulates the degree of change).

Diachronic inclusion is required at different "levels" of the object. We demand, of a watch, that stages of the watch head be diachronically included in one another, and so on for the watch head's significant proper parts. This recursive requirement can be characterized in the following manner:

Ch.4.8 Base clause: basic constituents are identical just when physics says so;
Induction clause: $\underline{\alpha} = \underline{\beta}$ if and only if $s(\alpha) \subseteq_D s(\beta)$.

This definition integrates significant proper part with the new interpretation of diachronic linkage. Consider the stage $\underline{A}$ of a watch and stage $\underline{B}$ of that watch with a new band. Is stage $\underline{A}$ diachronically included in stage $\underline{B}$? Notice that stage $\underline{A}$ is not diachronically linked with stage $\underline{B}$, since there has been overall a major quantitative change. Nonetheless, stage $\underline{A}$ is diachronically included in stage $\underline{B}$ because the watch head of $\underline{A}$, which is a significant proper

part of both stages, is the same watch head as the head of stage B. In the watch case, the wrist band is not a significant proper part of the watch, and since diachronic inclusion only requires that significant proper parts be recursively diachronically linked, the watch case presents no obstacles.[3]

There is a problem with the notion of diachronic inclusion which must be mended. Suppose stage A is a watch and that stage B is a gold statue with the watch head from A attached to the statue's body. Nonetheless, in this case, stage A is diachronically included in stage B, since all of the significant proper parts of A which are also significant proper parts of B (i.e., the head) have stages diachronically linked. But this is disastrous since whatever has happened in such a case, the changes are by no means minor. This problem is avoided by demanding full diachronic linkage.

D4.9 $\underline{s}_t, \underline{\simeq}_p \underline{s}'_{t'}$ if and only if $[(\underline{s}_t \underline{\leq}_p \underline{s}'_{t'}) \ \& \ (\underline{s}'_{t'} \underline{\leq}_p \underline{s}_t)]$.

Accordingly, two stages are fully diachronically linked just in case the one stage diachronically includes the other, and vice versa. This ensures that there will be a mutual "pairing" of significant proper parts between stages. In the watch/statue case just set out, stage B is not diachronically included in stage A, because although the shared significant proper part of the head's stages are diachronically linked, the significant proper part of the statue

(e.g., half of its mass) is not diachronically linked with the stage of any proper part of A. Hence, by requiring diachronic inclusion of both stages in one another, the problems outlined above disappear.[4]

II

The preliminary definitions have been formulated making it possible to now present my analysis of object persistence. This analysis will be set out in two steps, and a brief encapsulation of each step will first be given.

(1) The first step in my analysis starts from a given object-stage existing at a time. The analysis traces a determinate path "back through time" from this beginning object-stage. How is the tracing procedure regulated? By requiring all successive object-stages, that is, stages whose constitutive times are in decreasing sequence, in a sufficiently small interval of time to be fully diachronically linked. Such a relation can be called local full diachronic linkage; it starts with the given object-stage and follows back through time, all the while checking to be certain that the stages in a small temporal interval are fully diachronically linked. This process goes backward until a stage is reached where full diachronic linkage totally breaks down. When this occurs, that stage is known as the original ancestral object-stage with respect to the given beginning stage, and the path of backwardly traced stages is known as the complete ancestry of object-stages

with respect to the given stage. Hence, the first step of the analysis starts with a certain object-stage and traces the complete ancestry of that stage, via local full diachronic linkage, back to its original ancestral stage.

(2) Upon completion of the first step, the next step involves "turning around" and tracing forward in time, from the original ancestral stage, through the complete ancestry of stages up to the object-stage with which the trace initially started in the first step. However, this forward trace is different than the backward trace in the first step. Now, we require that the full diachronic linkage be global; that is, the analysis demands that the successive stages in the ancestry all be fully diachronically linked, not to one another in a small temporal interval, but each stage to the original ancestral stage itself. So, for each stage in the ancestry, the analysis checks if that stage is fully diachronically linked with the original ancestral stage. As this process goes along, histories of objects are partitioned off according to whether or not the original ancestral stage is fully diachronically linked with each stage in the ancestry. A bookkeeping method is introduced to keep track of the partitioned histories of objects. This is accomplished through a counting function, the tau-function, which counts the histories as the forward trace progresses. Finally, it is argued that a succession of object-stages are stages in the history of a single physical object just when this succession is a subset of a

single partitioned history in the relevant complete ancestry of object-stages.

(1) The strategy of the first step of the analysis is to trace a complete ancestry of stages back to the original ancestral stage. Given any T-stage at some time, we trace back in time and require that all the stages in a small temporal interval be fully diachronically linked with one another. This enables one to trace a continuous path from a stage back in time.

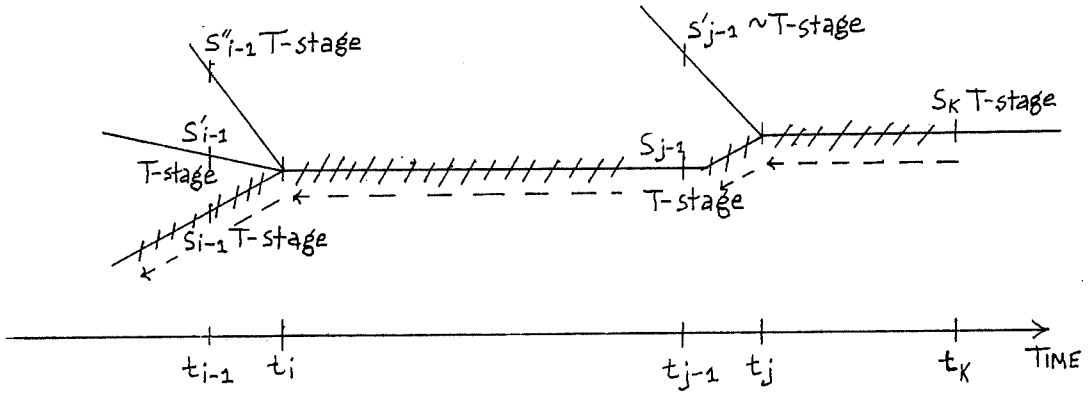
The definition of a continuous ancestry is given in terms of certain topological features, an advantage which allows us to clearly specify what constitutes a "small temporal interval." Simply put, for every stage in a succession, there will be an "open ball" which can be drawn around that stage within which the stages must be fully diachronically linked.

D4.10 A continuous ancestry of object-stages is a function mapping I into a set of stages $\{S_t\}_{t\in I}$ & $(\forall t\in I^*)$ $(\exists \delta)$ such that $(\forall t_1, t_2$ in $M\delta(t))$ $(S_{t_1} \simeq_0 S_{t_2})$, where $M\delta(t) = \{p: |t-p| < \delta\}$.

This definition enables us to trace a continuous path from a stage back in time, yielding a continuous ancestry of stages whose predominant feature is that the stages which make up the ancestry are all locally fully diachronically linked.

This tracing procedure, which follows from D4.10, can handle all types of fission cases as we are tracing backward;

of course, tracing forward in time this phenomena would appear as fusion cases. Consider the following diagram:



LEGEND

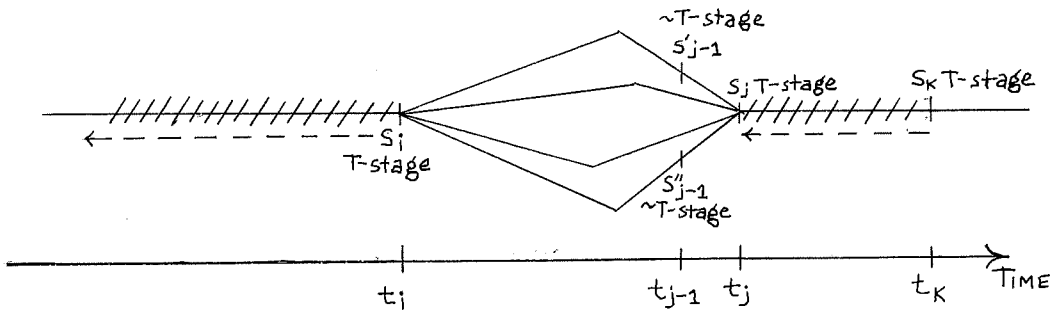
////: full diachronic linkage

←---: tracing continuous ancestry

Suppose there exists a time $\underline{t}_j < \underline{t}_k$ in this trace where the stage fissions but where only one of the branches falls under the relevant sortal $\underline{T}$. Then the continuous ancestry will continue to be traced along that branch. But, suppose that at a time $\underline{t}_i < \underline{t}_j \leq \underline{t}_k$, more than one of the branches falls under $\underline{T}$. The ancestry will follow that branch which extends full diachronic linkage and, of course, there can only be one such branch. Hence, the tracing procedure defined by D4.10 appears capable of handling all such fission cases. Accordingly, we can say:

D4.11 A continuous ancestry linking $\underline{s}\ (\alpha,\underline{t})$, $\underline{s}\ (\beta,\underline{t}')$ is a continuous ancestry $\underline{H}$ such that $\underline{s}\ (\alpha,\underline{t})$, $\underline{s}(\beta,\underline{t}')\ \ \underline{H}$.

Nonetheless, there is one case this tracing procedure cannot presently handle. Consider the following diagram:



LEGEND

//// : F.D. Linkage

←--: tracing continuous ancestry

Suppose that the stage fissions at $\underline{t}_j < \underline{t}_k$ and that none of the branches at $\underline{t}_{j-1}$ falls under sortal $\underline{T}$. Furthermore, suppose that there is some earlier time, $\underline{t}_i < \underline{t}_{j-1}$, in which the relevant parts of the $\underline{s}_{tj}$ stage come back together in an "appropriate fashion." If the stage $\underline{s}_{tj}$ when fission occurred is fully diachronically linked with the stage $\underline{s}_{ti}$ when the parts reassemble, then the tracing procedure takes up again and demarcates another continuous ancestry. Overall, then, we will have traced a <u>semi-continuous ancestry</u> of object-stages, from $\underline{s}_{tk}$ to $\underline{s}_{tj}$, and from $\underline{s}_{ti}$ backwards. A semi-continuous ancestry will be found in all cases in which an object is disassembled at a time, and put back together with the same parts at a later time.

D4.12 A <u>semi-continuous ancestry</u> $\underline{S}$ is a sequence $\{\underline{H},\ldots,\underline{H}_n\}$ of continuous ancestries such that $(\forall\, 1 \leq i \leq n)\ (\mu\text{-}(Hi) \simeq_p \mu\text{+}(Hi+1))$
where the μ-functions are defined as follows:
$\underline{\mu}+ =_{df.}$ takes the continuous ancestry into the <u>first</u> stage contained.
$\underline{\mu}- =_{df.}$ takes the continuous ancestry into the <u>last</u> stage contained.

Definition D4.12 works as follows. Suppose that D4.10 determines that local full diachronic linkage fails at some point. We then want to go back in time and see if there is any stage which is fully diachronically linked with that last stage inspected. The $\underline{\mu}$-function checks this feature, by taking the last stage of the first continuous ancestry H_1 (i.e., $\underline{\mu}$-(H_1)), and checking it for full diachronic linkage with the first stage of another potential continuous ancestry (i.e., $\underline{\mu}$+(H_2)). This procedure continues as long as necessary, all the while collecting a sequence $\{\underline{H}_1,\ldots,\underline{H}_n\}$ of continuous ancestries which form a semi-continuous ancestry with respect to a certain stage.

Chapter II raised a question about the possible need for a causal requirement in any analysis of object persistence. Presumably, such a requirement would be inserted at this juncture. Earlier it was claimed that after the stages fissioned off, they came back together in an "appropriate fashion." Just what constraints are there on this "appropriateness"? In other words, what kinds of phenomena can transpire during these intervals when the object is disassembled? Must there be some sort of regularity in the behavior which characterizes the way in which the parts come back together? My stance on this controversy remains the same as in Chapter II; I am neutral on the need for a causal requirement, and so too is this analysis. If it is decided that such a condition is needed, then it could be placed in my analysis without loss of coherence to the overall project.

On the other hand, if it is determined that such a condition would be superfluous, its absence would not diminish the analysis. It should be noticed that as my analysis stands, the following is required of the parts when they reassemble. First, the two respective stages must fall under the same relevant sortal. Secondly, they must be fully diachronically linked with one another. These requirements are strong enough to rule out a wide variety of aberrant cases.

Suppose that someone owns a necklace made out of pure 18 karat gold. But dissatisfied with the design, the necklace is taken to a craftsman who melts down the old necklace and builds a new necklace, out of a new design, from the same 18 karat gold that made up the original necklace. The "before" and "after" stages are all necklace-stages; however, the two stages are <u>not</u> fully diachronically linked. Why? Because there fails to be a match up of the significant proper parts of the "before" and "after" stages. The recursive nature of the analysis makes the identity of the object (necklace) dependent upon the identity of the significant proper parts; but since there has been a new design, there would fail to be the continued identity of the significant proper parts.

A more subtle case involves disassembling an object and reassembling it in a new fashion out of the old parts, being careful so that the same sortal is satisfied both before and after the process. But again, such an attempt

to foul up the analysis runs short. Suppose we have a statue of a person, and remove the torso of the statue and attach it to the head. The same parts are present both before and after, and it is possible that both stages might be considered statue-stages. However, again, there would fail to be full diachronic linkage between the stages. Why? Because we can draw different lines as to what constitutes a significant proper part of the object, and we can do it in such a way that the identity of the significant proper parts in the "before" stage is ruptured in the "after" stages. By using such measures, especially in such instances where it is not obvious what serves as a significant proper part, we can side-step odd cases of objects reassembled in odd ways. Hence, our requirements, as they are, disqualify many of the troublesome cases which originally made us consider a causal requirement.

The tracing procedure in which a semi-continuous ancestry is delineated continues until it is no longer possible to trace full diachronic linkage back any further. Of course, one must be certain that the parts do not come back together again and that another continuous ancestry is discovered. When such a stage is reached, we will have traced a maximal semi-continuous ancestry of object-stages. Of course, a continuous ancestry in which the stages do not fission and come back together again also qualifies as a maximal ancestry, when it too stops at a stage beyond

which further tracing is impossible. Consequently, the use of the term "maximal semi-continuous ancestry" should be taken to include those continuous ancestries which are maximal. The following definition can be given:

D4.13 $\{\underline{H}'_1,\ldots,\underline{H}'_n\}$ is a maximal semi-continuous ancestry if and only if:
(i) $\underline{H} \subset \underline{H}'$ if and only if $\underline{H}=\langle \underline{\leq},\underline{I}\rangle$ & $\underline{H}'=\langle \underline{\leq}',\underline{I}'\rangle$, and $\underline{\leq} \subset \underline{\leq}'$ & $\underline{I} \subset \underline{I}'$
(ii) $\{H_1,\ldots,H_n\} \subset \{H'_1,\ldots,H'_n\}$ if and only if $(\forall i \leq n)\ (\exists j \leq m)(\underline{H}_i \subset \underline{H}'_j)$.

Quite simply, a semi-continuous ancestry is maximal just when its constituent continuous ancestries are not properly included in a larger and more complete sequence of continuous ancestries. Such a semi-continuous ancestry is maximal; it represents the farthest one can go in tracing a sequence of semi-continuous ancestries.

Finally, it can be asserted that a complete ancestry is a maximal semi-continuous ancestry with respect to a given object at a given time, where this maximal ancestry is restricted and limited by the temporal position of the object-stage.

D4.14 $\underline{H}$ is a complete ancestry of object $\underline{o}$ at $\underline{t}$ if and only if $(\exists H')[(\underline{H}'$ is a maximal semi-continuous ancestry & $H'\restriction t=H)$ & stage $(o,t) \in \underline{H}']$.

Given this defined procedure for tracing a complete ancestry, it is easy to see what the original ancestral stage is.

D4.15 $\underline{s}_{t_1}$ is the original ancestral stage with respect to object $\underline{o}$ at $\underline{t}$ if and only if $(\exists$ complete ancestry $\underline{S}$ of $\underline{o}$ at $\underline{t})$ such that $\mu\text{-}(S) = \underline{s}_{t_1}$.

A stage $\underline{s}_{t_1}$ is the original ancestral stage with respect to object $\underline{o}$ at time $\underline{t}$ just in case there is a complete ancestry

$\underline{S}$ of $\underline{o}$ at $\underline{t}$ such that the first stage of $\underline{S}$ is $\underline{s}_{t_1}$. One might wonder if there must be such a stage? The answer is "yes" inasmuch as this stage must be used as the point of reference for the forward tracing process when we begin to partition histories.

This completes the first step of the analysis. What initially appeared to be a very intuitive idea has turned out to be quite difficult to formulate. This first step, then, takes us from a given object-stage at a time back to the original ancestral stage thereby tracing out the complete ancestry of the object.

(2) The second step of the analysis starts with the original ancestral stage of the complete ancestry, and traces forward in time, going through the successive stages of the ancestry. In the first step of the analysis, all that is required of a continuous ancestry is <u>local</u> full diachronic linkage, where the stages within a small temporal interval must be fully diachronically linked. In this second step of the analysis, however, <u>global</u> full diachronic linkage is demanded. It is global in that all successive stages of the ancestry, when tracing forward, must be fully diachronically linked with the original ancestral stage. This is a more restrictive requirement to be sure, and it will yield different results in tracing than the local variety.

Why the different uses at such different times? When the ancestry is being traced in the first step, we are not concerned with object persistence except to the extent that

the stages must all fall under the same sortal and quantitatively overlap their neighbor stages. However, when it comes time to demarcate actual points at which objects come into and go out of existence, in the second step of the analysis, we demand that the stages' significant proper parts compositionally overlap with those of the first stage; this is consistent with the methodological considerations presented in Chapter II in the stereo case. When we require global full diachronic linkage, much less overall change is admitted into the history of an object.

What is presently needed is a bookkeeping method which will keep track of all the objects traversed in the forward trace. We begin with the original ancestral stage and check successive stages, that is, stages in the ancestry whose constitutive times are in increasing order, to see if those stages are fully diachronically linked with the original stage. As long as these stages are so related to the original stage, such a succession of stages constitutes a single partitioned history of a physical object. At some stage, it might be determined that such a stage is no longer fully diachronically linked with the original stage. Then, the bookkeeping method registers "one complete history", and the entire process is taken up again. However, we no longer require that the successive stages be linked with the original stage. Rather, this new stage, which is the least upper bound of the former complete history, becomes the point of reference against which all remaining successive

stages in the ancestry are checked for full linkage. This procedure continues on and on, partitioning and registering complete histories whenever necessary, until the last stage of interest is encountered. So, in a complete ancestry, there might be only one complete partitioned history, or there might be several; whatever the number, they will be recorded by the bookkeeping method.

This bookkeeping method can be formalized by the introduction of the $\underline{\tau}$-function (tau-function), which is primarily a "counting" function. This definition can be presented:

D4.16 $\underline{\tau}(K) =_{df} .\sup \{t:t \geq t_1 \ \& \ s_{t_1} \simeq_p s_t\}$, &
$\underline{\tau}(K+1) =_{df} .\sup \{t:t \geq \tau k \ \& \ S_{\tau_k} \simeq_p S_t\}$ if any.

The tau-function begins with the original ancestral stage $\underline{s}_{t_1}$ and checks successive stages to determine if they are fully diachronically linked with $\underline{s}_{t_1}$. It pursues this goal to the least upper bound, if any, and begins the checking and counting process again from that bounded point.

Having defined the bookkeeping tau-function, a formal definition of a partitioned history can be laid out:

D4.17 $\underline{\emptyset}$ is a partitioned history with respect to object $\underline{o}$ at time $\underline{t}$ if and only if ($\exists$ complete ancestry $\underline{S}$ with respect to $\underline{o}$ at $\underline{t}$) ($\exists$ an original ancestral stage $\underline{s}_{t_1}$ with respect to $\underline{o}$ at $\underline{t}$) such that the K-value of the $\underline{\tau}$-function is a fixed $\underline{K}$, where $(K) = \sup \{t:t \geq t_1 \ \& \ s_{t_1} \simeq_p s_t\}$ & $(K+1) = \sup \{t:t \geq \tau_K \ \& \ s_{\tau_K} \simeq_p s_t\}$ if any.

A partitioned history is articulated only after a complete ancestry and original ancestral stage have been pinpointed with respect to a particular object existing at a time. The tau-function will remain a fixed $\underline{K}$-value as long as the

successive stages are fully diachronically linked with either the original ancestral stage, or with that stage which is the least upper bound if the checking process had to start over again. Hence, as long as the value of the tau-function remains constant, a single history is being partitioned. If that value of the tau-function changes, the history is fully and completely partitioned, and a new history begins to be partitioned as the trace continues forward through the complete ancestry.

This completes the presentation of the mechanics of my analysis of object persistence. Quite straightforwardly, my analysis can be given as follows:

D4.18 A succession of object-stages $\{\underline{s}_1,\ldots,\underline{s}_n\}$ are stages in the history of a single physical object if and only if ($\exists$ a complete ancestry $\underline{S}$) ($\exists$ partitioned history $\underline{\emptyset}$) such that $\{\underline{s}_1,\ldots,\underline{s}_n\} \in \underline{\emptyset}$ & $\emptyset \in \underline{S}$.

Although it took a number of steps and definitions to get this completed analysis of object persistence, it is hoped that the intuitive simplicity of the original insight has been captured in the final product.

III

Does this analysis present both necessary and sufficient conditions for object persistence? The success of any analysis can only be determined by checking it against a variety of core cases to see if the proper results are produced. In the ensuing discussion, two cases are looked at,

both of which are quite familiar from previous Chapters.

(1) How does D4.18 adjudicate the stereo case? In the first instance, let us suppose, we have a stereo $\underline{X}$ sitting in a corner of a room at time $\underline{t}_i$. At a time $\underline{t}_j$, where $\underline{t}_i \leq \underline{t}_j < \underline{t}_k$, we begin to remove parts from stereo $\underline{X}$ so that at time $\underline{t}_k$ we have stereo $\underline{Z}$ with all new parts, which were used to replace the parts removed from $\underline{X}$. Furthermore, suppose we reassemble the discarded parts from stereo $\underline{X}$ to build stereo $\underline{Y}$ which also exists at time $\underline{t}_k$. Now, then, consider time $\underline{t}_{k+1}$. There are two pertinent questions which must be asked: (a) is stereo $\underline{X}$ at $\underline{t}_i$ identical with stereo $\underline{Z}$ at $\underline{t}_{k+1}$? That is, is the succession of object-stages $\{\underline{s}(X,t_i),\ldots,\underline{s}(Z,t_{k+1})\}$ from stereo $\underline{X}$ to stereo $\underline{Z}$ stages in the life of a <u>single</u> physical object?; (b) is stereo $\underline{X}$ at $\underline{t}_i$ identical with stereo $\underline{Y}$ at $\underline{t}_{k+1}$? Again, this is to ask whether or not the succession of object-stages $\{\underline{s}(X,t_i),\ldots,\underline{s}(Y,t_{k+1})\}$ from stereo $\underline{X}$ to stereo $\underline{Y}$ are stages in the history of a single stereo?

Let us consider case (a) first. In keeping with my analysis, we first attempt to construct a complete ancestry of stages with respect to $\underline{s}(Z,t_{k+1})$. We begin with that stage tracing backward, asking all the time whether or not the stages within a sufficiently small temporal interval are fully diachronically linked. It can be seen that they indeed are fully diachronically linked within the small temporal

interval first considered. We continue to trace backward without interruption until we reach $\underline{s}(X,t_i)$. Of course, this stage is not the original ancestral stage and the tracing would continue backward until the time of stereo X's origination. Ex hypothesi, suppose that stereo X has not changed substantially from its creation to $\underline{s}(X,t_i)$.

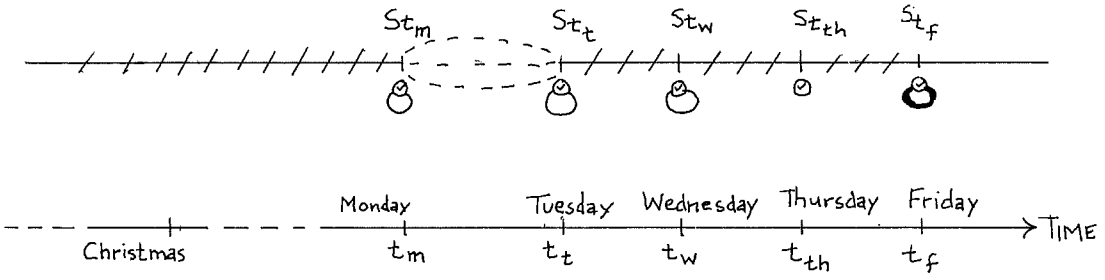
Given the finished tracing of this complete ancestry, we can undertake the second step of the analysis. Specifically, we want to determine if the succession $\{\underline{s}(X,t_i),\ldots,\underline{s}(Z,t_{k+1})\}$ in its entirety is part of the same partitioned history. If so, then stereo X is identical with stereo Z; if not, then they are different objects altogether. For each stage in this succession, we check to see if that stage is fully diachronically linked with the original ancestral stage. As long as it is, the tau-function will produce a fixed k-value. But at a certain point in the checking process, when approximately half of the proper parts of stereo X have been removed, we will find that such a stage is no longer fully diachronically linked with the original ancestral stage. At that point, the tau-function will register "one complete partitioned history", and begin the process again. Hence, this succession under consideration is not part of the same partitioned history. It follows that stereo X is not identical with stereo Z.

In considering case (b) the same procedure is followed. We begin with stage $\underline{s}(U,t_{k+1})$ tracing backward, asking whether or not the stages within a small temporal interval

are fully diachronically linked. At a time $\underline{t}'$, where $\underline{t}_j < \underline{t}' < \underline{t}_k$, the stages will no longer be fully diachronically linked. In fact, none of the branches will fall under the relevant sortal 'stereo' at that juncture. The succession from $\{\underline{s}(Y,t_{k+1}),\ldots,\underline{s}(Y,t')\}$ constitutes a continuous ancestry. Still tracing backward, we see that the parts of stage $\underline{s}(Y,t')$ come back together in an "appropriate fashion" at time $\underline{t}''$, where $\underline{t}_j < \underline{t}'' < \underline{t}'$. We then inquire if stage $\underline{s}(Y,t')$ is fully diachronically linked with the stage $\underline{s}_{t''}$. In fact, we see that it is, so that another ancestry is demarcated from that stage $\underline{s}_{t''}$ back through time, to stage $\underline{s}(X,t_i)$, and finally back to some original ancestral stage. In this case, unlike case (a), we have a maximal semi-continuous ancestry, from $\{\underline{s}(Y,t_{k+1}),\ldots,\underline{s}(Y,t')\}$ and from $\{\underline{s}_{t''},\ldots,\underline{s}(X,t_i),\ldots,\underline{s}(X,t_1)\}$. We want to know if this semi-continuous ancestry in its entirety is part of the same partitioned history. If it is, then stereo $\underline{X}$ is identical with stereo $\underline{Y}$. We check to see if the stages are all fully diachronically linked with the original ancestral stage $\underline{s}(X,t_1)$. While this holds constant, the $\underline{k}$-value of the tau-function remains the same, indicating a single history. The tau-function certainly remains constant through the following succession, $\{\underline{s}(X,t_1),\ldots,\underline{s}_{t''}\}$. At that point, following the semi-continuous ancestry, the tau-function checks to see if $\underline{s}(X,t_1)$ is fully diachronically linked with $\underline{s}(Y,t')$, the *first* stage when the object comes back into existence after having been taken apart; it turns out

that these stages are fully linked. Hence, the checking process continues until we reach stage $\underline{s}(Y,t_{k+1})$, which is still fully diachronically linked with the original ancestral stage $\underline{s}(X,t_1)$. Consequently, the tau-function held constant throughout the long checking procedure. Accordingly, it follows that the succession $\{\underline{s}(X,t_1),\ldots,\underline{s}(Y,t_{k+1})\}$ is part of the same partitioned history, and that stereo $\underline{X}$ is indeed identical with stereo $\underline{Y}$.

(2) We will next consider a variant of the watch case. Suppose that Ms. Friend is given a new Seiko watch for Christmas. In March the watch stops running, and on the following Monday she takes it in to be repaired. From Monday to Tuesday, the jeweler has the watch disassembled and he replaces a spring in the watch head. Ms. Friend picks up the watch on Tuesday afternoon. Moreover, she decides to buy a new watch band on Wednesday; but after taking off the original Seiko band, she decides not to put the new band on until Friday, choosing to just carry the watch head around in her purse on Thursday. The following diagram represents this chain of events:



The pertinent question ponders: is the watch on that Friday the same object as the watch Ms. Friend received for a gift at Christmas?

According to my analysis, the first task is to trace a complete ancestry of the watch with respect to the watch at stage $\underline{s}_{t_f}$. Going backward, we trace a continuous ancestry from stage $\underline{s}_{t_f}$ to $\underline{s}_{t_t}$. That is to say, there is a small temporal interval we can specify such that all of the stages of the significant proper parts (i.e., the watch head) within that interval are fully diachronically linked. However, the object "goes out of existence" at time $\underline{t}_t$ when the stage $\underline{s}_{t_t}$ fissions. This corresponds to the watch being reassembled during the forward trace; but in the backward trace, the stages fission. But, there is a stage $\underline{s}_{t_m}$ such that the parts of $\underline{s}_{t_t}$ are reassembled in an "appropriate fashion" at $\underline{t}_m$, and stage $\underline{s}_{t_t}$ is fully diachronically linked with stage $\underline{s}_{t_m}$. Accordingly, the tracing procedure begins again at $\underline{s}_{t_m}$, back through time, past Christmas, and back to some time when the watch was first manufactured by Seiko. This tracing procedure picks out a maximal semi-continuous ancestry of stages with respect to the watch at $\underline{t}_f$. The ancestry is semi-continuous because $\underline{s}_{t_f}$ to $\underline{s}_{t_t}$ is a continuous ancestry, and $\underline{s}_{t_m}$ back to the original ancestral stage is also a continuous ancestry. When this maximal semi-continuous ancestry is restricted to time $\underline{t}_f$, we have a complete ancestry of stages for the watch at $\underline{t}_f$.

Given the complete ancestry of the watch, we turn around and begin to trace forward, partitioning histories which are counted off by the tau-function. Supposing that stage $\underline{s}_{t_1}$ is the original ancestral stage for the watch, it can be seen that all stages in the complete ancestry up to stage $\underline{s}_{t_f}$ are fully diachronically linked with the original ancestral stage $\underline{s}_{t_1}$. Hence, the $\underline{k}$-value of the tau-function remains constant from $\underline{s}_{t_1}$ to the last stage under consideration $\underline{s}_{t_f}$. As stipulated by D4.18, then, the succession of stages $\{\underline{s}_{t_1},\ldots,\underline{s}_{t_f}\}$ constitutes a history of a single physical object; namely, Ms. Friend's Seiko watch. Thus, the answer to the question regarding whether or not the watch on that Friday is the same object as the watch given Ms. Friend on Christmas can be answered affirmatively. The stage of the watch at Christmas is a member of the same partitioned history as the stage of the watch on that Friday.

This completes Chapter IV and the presentation of my analysis of object persistence. In the remaining Chapters, I will investigate the ramifications my analysis has for certain metaphysical questions.

CHAPTER V

NECESSITY OF ORIGINS

In this Chapter I begin investigation of a thesis greatly debated within contemporary metaphysics. The thesis concerns whether or not an object's origins are necessary or essential to that object. This position is supported by Kripke[1] and Gibbard,[2] although there remains a substantial amount of mystery regarding the details of this thesis. Most importantly, what is understood to constitute an object's "origins"? Depending on how this is answered, the stock of the thesis rises or falls. In the first part of this Chapter, I demarcate four possible positions on what might constitute an object's origins. Thereafter, I set out a constituent ontology which facilitates a clearer delineation of a special set of properties. These properties, termed original$_4$ properties, will be of central interest in Chapter VI where we finally decide whether an object's origins are essential.

The claim that an object's origins are essential comes from Kripke. It is not clear, however, as to the parameters Kripke places on "origins." That is, there are several interpretations of what comprises an object's origins, and Kripke might straddle this line to some extent. Nonetheless, the intuitive backing to his ideas are discernible in his discussion. Kripke believes that if a material object has

its origin from a certain hunk of matter, it could not have had its origin in any other matter.

The following example underscores Kripkean-style necessity of origins. Consider a particular oak table. Kripke would claim that it is not possible that <u>that</u> oak table be made from anything other than the piece of oak it is actually made out of. Someone might argue that they can imagine the circumstances in which <u>that</u> table is not made out of that piece of oak. Those who claim that they can imagine these circumstances are confusing the hypothetical circumstance in which a table other than <u>that</u> table fails to be made out of that oak, with the putative but impossible circumstance of <u>that</u> table not being made out of that oak. This, then, appears to be the force of Kripke's arguments, although again it remains to be seen how broadly we understand an object's "origins."

What are the possible interpretations of what constitutes an object's origins? Associated with any object's origins will be a class of properties descriptive of various features of the object at its moment of origination. In the main, questions about what constitutes an object's origins concern what properties belong in this class. Does the class include all properties of the object, or only some?

Prior to an examination of different interpretations of "origin", what does it mean to say that origins are essential or necessary to an object? The notion of a necessary (or

essential) feature is a metaphysical notion and not a matter of how we come to know something. As such, a necessary feature of an object would be a feature (or property) which could not have been different. To say that an object's origin is necessary is to assert that the object's origin (on whatever interpretation of "origin") could not have possibly been different than it was. This origin will be the way it is no matter how different the world might be; provided, of course, that the object comes into existence.

There are three interpretations of what constitutes origins. (1) "An object's $\underline{\text{original}}_1$ properties are essential to that object." What comes under the banner of "original_1" properties? All properties which characterize the object's origins. This position is the strongest possible position on this question. Both relational and nonrelational properties[3] are included in "original_1" properties. For example, if a statue comes into existence on 19 October 1956 in a certain studio in Detroit, it is a necessary feature of that statue that it came into existence under these circumstances. Accordingly, it is not possible that that statue have been made on 20 October 1956, or in a different studio in Detroit or anywhere. Furthermore, any relational properties which are descriptive of the statue's origin would be essential to that object. If the statue came into existence and was 20 feet away from a certain work table, this would be an essential property of the statue's origin.

Beyond such relational properties, all nonrelational properties, such as the object being made out of a certain piece of gold, in a certain shape and so on, will be original$_1$ properties of the object. With respect to biological organisms (outside the scope of this overall project), such as humans, the original$_1$ class of properties would include the gametes from the actual parents as being essential. But further, this class would include the moment and place of fertilization as being essential features. Supposing that this fertilization took place in a 1958 Chevy Impala, such a feature would be essential to the human being (zygote) in question; that is, it is not possible that that fertilization could have taken place anywhere other than in the backseat of that Chevy.

These examples clearly indicate the strength of this position. The class of original$_1$ properties includes everything about an object's origins and steadfastly maintains that circumstances could not have been different with respect to any of these features. To change any of these features is to change the identity under consideration. Furthermore, <u>any</u> property, such as 'being red', can be made original$_1$ by temporally indexing it, such as 'being red at time t_0.' This possibility of temporally indexing properties greatly increases the class of original$_1$ properties. As such, this class is indeed awesome.

(2) The second interpretation loosens some of the requirements just postulated. The class of original$_2$ properties excludes the explicit reference to an object's time and place of origin. This class of properties excludes the historical features of an object's beginnings. For example, this class would rule out the fact that the statue is made in the studio that it is, or on the date that it is.

A further stricture on the class of original$_2$ properties, is that these properties must be "purely qualitative." The adjectival phrase "purely qualitative" allegedly differentiates between those properties, such as being four feet tall or being green, that don't "make reference to particular objects," as do properties like being Jimmy Carter's brother or being Michael Kump.

> Px is purely qualitative if and only if $\sim\exists Q(x)$ such that Q(x) involves an expression referring to particular things, and Q(x) is analytically equivalent to P(x).

It might be wondered if in fact any properties fit this stricture? The motivation behind this feature of original$_2$ properties is to rule out properties which explicitly refer to the object's relation to other particular objects at the moment of origin. It is felt that extrinsic features concerning an object's origins are not essential to the object. Original$_2$ properties exclude relational properties which expressly refer to existing individual objects. So, it is urged that the question of where a statue comes into

existence is irrelevant; rather, what is important is that the statue is originally made out of a certain piece of gold. Likewise, in the human case, what is essential are the actual gametes which result in the zygote, not the time or place at which this fertilization process occurs. There is a problem here, however, since presumably any reference to such gametes would include reference to the donors (i.e., the parents), and such relational properties are certainly not purely qualitative. Consequently, unless reference to the matter of the gametes can be accomplished without reference to the relational property of 'being the gamete of Mr. So and So', such properties are excluded from the class of original$_2$ properties. This difficulty appears to be limited to biological organisms, although as we will see shortly, this is not so obvious.

(3) The third interpretation, regarding original$_3$ properties, is a refinement of position (2). This grouping continues the trend of trying to specify "intrinsic, self-complete" criteria for when an object's origins are essential. This class of properties differs from original$_2$ properties by ruling out each and every possible relational property which is descriptive of the object's origins. It might be thought that original$_2$ properties already accomplished this. However, that is not so. Something like the following description will count as an original$_2$ property: $(\exists x)\ (\exists y)$ ($\underline{x}$ is a statue & $\underline{x}$ is 20 miles away from $\underline{y}$). As it is

expressed, this will not quite do; through doctoring up the description, however, one would be able to get rid of the reference to "20 miles" in the example while retaining the thrust of the description. Accordingly, the class of original$_3$ properties arise because this type of "covert" relational property slips in the back door of original$_2$ properties. Original$_3$ properties extend the demand for qualitative properties which are totally devoid of <u>relational</u> reference, whether that reference be to an actual individual or to some existentially quantified description as given above. The idea behind original$_3$ properties is that they do not require relational properties in their expression. The above characterization says in effect that there does not exist an expression Q(x) which is a compound analytically equivalent to the original P(x), in which there exists a relational property which cannot be eliminated from the compound Q(x). Examples, then, of original$_3$ properties are 'being (made out of) gold', or 'being (painted) red', and any other purely qualitative property.

(4) It might seem as though the range of original properties delineated by these three groups exhausts the various possibilities; in a sense, this is correct. However, there is a further classification which includes certain relational properties while excluding others, and which covers a certain brand of qualitative property while ruling out others. As far as I can discern, this group of

original$_4$ properties might be the class which Kripke believes are essential to an object. At this stage, however, we will only demarcate the extension of original$_4$ properties, leaving the assessment of Kripke's claim for Chapter VI.

Original$_4$ properties, unlike original$_3$ properties, includes some relational properties. It is not easy to precisely draw the line between those relational properties to be let in and those to be kept out. Nonetheless, it is possible to give a fairly strong indication of how this should be accomplished.

Original$_4$ properties do not include relational properties concerning the time and place of an object's origins; that is, spatio-temporal properties of the object's coming into existence are considered irrelevant, a claim also made by both original$_{1\&2}$ property groups. What relational properties are allowed? There are primarily two such sets of properties: (i) "Internal" relational properties of the object, such as the object's (significant) proper parts being structured in a certain fashion. It is by no means obvious that these properties, which I shall term "internal structural properties", are ruled out by original$_3$ properties, although it appears that they are out since they are a kind of relational property. Whatever the case, original$_4$ properties explicitly cover this type of relational property. Such internal structural properties are undoubtedly governed by features of the relevant sortals. Consider a 'watchhead.' It will not suffice to have just any random

assortment of watchhead proper parts strung together; rather, they must be put together in some fashion so that the assemblage of proper parts satisfies the sortal 'watchhead.' Consequently, such internal structural properties are allowed in under original$_4$ properties.

(ii) The other relational property to be included is best picked out by the Kripkean example concerning a person and their relation to their parents. Kripke argues that a person possesses a special (metaphysical?) relationship to their parents. We could not fail to have the parents that we in fact have, although the spatio-temporal parameters surrounding the fusion of the parental egg and sperm can vary without disruption to the case. This type of relational property, which I shall term "external hereditary property", is clear for biological organisms which originate in the union of egg and sperm. But since these cases are outside the scope of my analysis, although I do at times draw upon them for guidance and clarification, it is unclear what, if anything, serves as external hereditary properties for the physical objects I am considering (e.g., artifacts such as tables, chairs, statues, stereos, etc.).

One suggestion would be that in some cases the relevant object-sortal indicates if external hereditary properties are important. One example would be the sortal 'art object.' Carrying this line out, we might say that a Calder mobile, or a Miró painting, could not have had a different creator

than it did; if so, then we have a different object, namely, a forgery. This seems plausible for special cases like 'art objects.'

But is it plausible to claim that there are relevant external hereditary properties for more "mundane" objects like tables and chairs? Consider a piece of clay called "Lumpl", and a statue named "Goliath" which is made out of Lumpl. Is it essential to Lumpl that it had its origin in the statue Goliath? No, it seems not. But an assymetry exists because we cannot imagine the statue Goliath having its origin in any other piece of clay than Lumpl. To tie this in with Kripke's comments on biological organisms, we can say that Lumpl bears a relation to Goliath which is like that of parent to child; the difference resides in the use of the expression 'is composed of' when speaking of the Lumpl/Goliath relationship. Consequently, there is a sense in which external hereditary properties are intelligible for objects such as tables and chairs. They are to be understood as involving this assymetry pointed out above. As this discussion continues, further light will be shed upon features of external hereditary properties.

Besides these relational properties, original$_4$ properties also include a special brand of qualitative property. We want to exclude qualitative properties such as 'being red.' This demarcation appears to coincide with the distinction between compositional and noncompositional qualitative

properties; original$_4$ properties cover only the former, not the latter. More specifically, these properties might be called "causally necessary properties." They are properties exemplified by an object because of the micro-physical structure of the object's substance or proper parts. This claim must be restricted, however, by specifying those structural interactions which are relevant. If you are going to allow anything which is "causally necessary" to be essential, there is very little that won't turn out as being essential--even 'being red'. In the remainder of this Chapter and subsequent Chapters, I delineate those micro-physical features which will be the focus of our attention in searching for essential properties. The notion of "causally necessary" property will undergo certain refinements in that discussion.

Any attempt to give a full rendering of why certain properties are causally necessary becomes quite complicated. In the extended discussion which follows, I explicate the relationship which is responsible for the existence of causally necessary properties, terming this relationship "substance-constitution", or just "s-constitution." The delineation of s-constitution unfolds through the development of a constituent ontology in which property-features of any substance can be explained <u>via</u> the relationship between the basic constituents belonging to the substance.

The first step in delineating the notion of s-constitution is to establish a foundation upon which this

notion can be built. Historically, there have been two approaches available for any task of this general type: (a) build up a hierarchy of intuitions in a phenomenological manner by beginning with those intuitions which are most fundamental concerning the phenomenon to be described; (b) the theoretical approach whereby one chooses certain primitives as the most fundamental elements in the theory, although such primitives do not necessarily correspond to our most fundamental intuitions. I have chosen the second methodology since it suits my purposes best and possesses few inherent limitations. Nonetheless, the divergences between the results of these two routes in this case do not seem potentially great. Indeed, my account receives intuitive confirmation at all junctures.

The two primitives to be introduced are stuff and basic constituent. They provide us with a starting point for the development of a constituent ontology. As primitives they are the fundamental ontological units from which the concept of s-constitution receives significance. However, even though they are introduced as primitives, that is as undefined notions, it is still possible to say quite a great deal about them. This can be done by pointing to examples of stuff and basic constituents, and by providing helpful characterizations which capture the core notion behind these primitives. These notions, it turns out, are not ill-understood. Consequently, in undertaking an analysis of

s-constitution by means of these primitives, our analysis will rest upon a secure foundation which is neither obscure nor unilluminating.

What can be said about the primitive 'stuff' to illustrate what this notion captures? First of all, it is possible to put forward examples of stuff. One example would be the matter which makes up a chair. We often employ the expression, "the stuff which that chair is made out of" in a manner compatible with the picture being drawn here. Stuff makes up any and all chairs; accordingly, it is matter not specifically identified as anything other than "some stuff." This point can be strengthened when additional examples of stuff are given. Stuff is the unspecified matter which makes up chairs, tables, rocks, trees, bridges, buildings, and persons. Stuff is not restricted to just natural or to just man-made artifacts. On the contrary, as the examples indicate, stuff ranges across all lines of classification inasmuch as stuff is what all physical objects are made up of.

The delineation of stuff can be furthered by giving some examples of things which are not stuff. To say that something is not stuff is to say that this thing is not made up of stuff. Such examples would be shadows, surfaces, the University of Michigan, the United States of America, and vacuous space-time volumes. Although this list is not exhaustive it does help fashion a picture of what stuff seems to be.

Looking at these two groups of stuff and non-stuff, it is possible to pick out certain similarities which differentiate between these groups. What do the members of the group of stuff exemplify which the non-stuff group fail to exemplify? One of the most noticeable features exemplified by stuff is three-dimensional bulk. To claim that stuff has bulk is to claim that stuff is a certain portion of matter with a specific mass and volume. This fact is underscored by stuff's three-dimensionality; by stuff's length, width, and height. Characteristically, stuff can be weighed for its mass and measured for its size and physical dimensions. Three-dimensional bulk, then, is a characteristic of the stuff of chairs, of trees, or persons, and the like. A chair weighs just so much and is so big; in other words, a chair has just that much stuff.

On the other hand, such a characterization cannot be given of shadows, of surfaces, or of the University of Michigan. Of course, one can "break down" the physical University plant into its components; for example, Angell Hall has so much stuff. But the point is that 'the University of Michigan' is not a physical entity as much as it is a legal entity. The University is more than the sum total of its physical plant. It goes beyond that, and hence it is not appropriate to talk about the University having so much stuff, except in the (trivial) fashion indicated. The same goes for the United States and the solar system. Of course, these entities are composed of units of stuff,

such as the planets comprising the solar system, but their status as entities goes beyond the role of their component stuff.

These examples also bring out another feature about stuff which is important: the macro-continuity of stuff. It is this feature which helps indicate why a University or a solar system are not stuff (simpliciter). What is meant by the macro-continuity of stuff? Ultimately, everything in the physical universe is constituted out of stuff. However, we encounter stuff, or if you prefer, stuff exists only as some stuff, as units of stuff. The notion of macro-continuity points to this fact by emphasizing the macro-physical continuity of matter, distinctive of units of stuff. It is a continuity of stuff which makes the unit, a unit of something. For example, a table and six chairs are so much stuff. It doesn't matter if they are all oak or all similar; stuff is not type-dependent but is unidentified beyond its status as stuff. The table and chairs are each themselves a specific unit of stuff. Each chair made up of some stuff is only macro-continuous with itself; that is, each chair is discontinuous with each other chair and with the table thereby being a (separate) unit of stuff. The macro-continuity of stuff, then, explains why stuff is found as discrete units of stuff. Moreover, macro-continuity can be understood as a complement to the three-dimensional bulk of stuff. In a sense, shadows or surfaces (non-stuff) might seem macro-continuous. However, their lack of

three-dimensional bulk indicates that their macro-continuity, if considered to be such, is not a feature attributable to their status as stuff.

Even though stuff is a primitive there has not been a lack of things to be said about it. This can be characterized accordingly:

> Primitive 1. Necessarily, any x is composed of (some) stuff only if: x possesses three-dimensional bulk; and x is located in some place at some time.

This characterization is not offered as a definition but only as a helpful attempt to solidify the foregoing discussion. One of the most important features of stuff is not mentioned in P1. At certain levels of analysis we do not distinguish different types of stuff. Stuff is ontologically independent of the forms it can take, and the same stuff could possible exist in different forms. Consequently, there are not different grades of stuff ontologically: all and any stuff is just some stuff.

In a manner similar to that above, helpful characterizations can be offered concerning the other primitive, basic constituent. Instead of beginning the discussion with a list of examples of basic constituents, the most fruitful approach would be to put forward some highlights about basic constituents.

The central notion underlining the primitive 'basic constituent' is "breakupability." Stuff can be broken down into component entities as one moves from the macro to the

micro level. The notion of an 'entity', a particular and discrete thing existing independently, comes into play here. Even as stuff can be broken down or decomposed into smaller and smaller entities, there comes a point at which the very possibility of "breakupability" ceases to exist. At such a point, it is necessarily impossible to further break these entities into still more simple or basic entities. These simplest and most basic entities are basic constituents. There existence is posited with the introduction of the primitive 'basic constituent.' To say that basic constituents cannot ultimately be broken down into more basic entities is to say that a basic constituent is an entity no proper part of which is an entity. Correspondingly, a basic constituent has no internal structure, as would be expected given these other features.

What sorts of things are basic constituents? The answer to this question does not come from the philosopher but rather from the theoretical physicist. Years ago physicists postulated the existence of entities which correspond to my basic constituents. It was claimed that these entities, called quarks, had to exist for a variety of reasons. Their hypothesis has received some empirical confirmation recently. As such, it can be said what sorts of entities are not basic constituents: atoms, molecules, electrons, neutrinos, the University of Michigan, and the like. Even if it should be experimentally demonstrated that quarks are not basic constituents, such results do not damage

my theory in the least. My positing of basic constituents as primitives is motivated for ontological reasons; namely, that stuff must be decomposable into entities which themselves cannot be decomposed. Hence, if basic constituents are not quarks then my basic constituents are some other entity as yet undiscovered by empirical science.

The primitive of basic constituent plays a crucial role in s-constitution. The following characterization can be offered as a synopsis of the discussion.

> Primitive 2. Necessarily, any y is a basic constituent only if: y is an entity no [proper part] of which is an entity; y possesses no internal structure; and y cannot break up into any other entity or entities.

The question should be raised as to what the relationship is between stuff and basic constituents. It is clear that stuff is made up of basic constituents. But what does it mean to say that "some stuff has basic constituents" or that "basic constituents belong to some stuff?" All such expressions assert only that some stuff has basic constituents as spatio-temporal parts and nothing more. This point is central and must be underlined. When the expression "some stuff has basic constituents" is used, then, it will be understood in this indicated sense. The part/whole features of basic constituents are such that conceptually they can be broken up, but physically they cannot since they have no particles as proper parts. We do not make the distinction between physical and metaphysical necessity for basic

constituents; since it is physically impossible to break them up, that is enough and we could say that it is also metaphysically impossible.

It is not a feature of a basic constituent that the basic constituent necessarily belong to some stuff. It is possible for a basic constituent to be a free basic constituent; that is, a basic constituent which is not a spatio-temporal part of some other stuff but which exists "free" and "unattached" to any other basic constituent at that time. Coincidentally, physicists are presently trying to discover experimental evidence of a free quark whose existence they have postulated. That there exist free basic constituents is not disturbing in the least.

In summary, the relationship between stuff and basic constituent can be expressed thusly: (i) All basic constituents are (some) stuff. This is not surprising since basic constituents fit all the "criteria" for stuff expressed in P1. Of course, we might not yet possess the technology by which we can weigh and measure the stuff of a basic constituent, but theoretically there is no reason to suspect it could not be accomplished. So, necessarily, if w is a basic constituent then w is (some) stuff. (ii) All stuff has basic constituents as spatio-temporal parts and nothing more. This claim must be understood broadly so that it remains consistent with the existence of free basic constituents. Now a free basic constituent is some stuff and

it does have a basic constituent as a spatio-temporal part; namely, itself, in a reflexive manner.[4] Consequently, with this concession, the claim that: necessarily, if u is some stuff then u has basic constituents, can be upheld and accepted.

This enterprise of introducing the primitives can be placed into a final perspective by indicating the following: basic constituent is the major ontological primitive at the micro-level, and stuff is the major ontological primitive at the macro-level. As has been witnessed, their roles are intertwined and complimentary. Upon this foundation of primitives, then, the definition of s-constitution will hold forth.

With the primitives established the process of developing a constituent ontology can proceed upon this foundation. Whenever stuff has basic constituents as spatio-temporal parts, these basic constituents will be arranged in a pattern of structural interaction. This broad notion is central to understanding the relationship between basic constituents. To say that some basic constituents are in a certain structural interaction is to say that these and only these basic constituents are positioned with respect to each other in a specifiable manner. Moreover, their specific positioning to each other involves them in a predictable interaction. But what is it for basic constituents to "interact?" The precise manner in which the basic constituents

are positioned as spatio-temporal parts within the structure of the unit of stuff determines how these basic constituents affect the appearance of the stuff at the micro and macro level. When the basic constituents are in different structural interactions their causal influence upon the stuff to which they belong can shift.

The manner in which the notion of structural interaction is here introduced undoubtedly involves a simplification of what does in fact occur among basic constituents at the micro-level. As such, this notion is being used as a sweeping term for many phenomena. For example, physicists are beginning to find that quarks' interactions with each other help determine properties exemplified by the quarks, such as strangeness. My notion of structural interaction is intended to capture all of this within its purview. Consequently, it stands that the notion of structural interaction covers any micro-phenomena which results because of the actual physical positioning of basic constituents with each other *qua* spatio-temporal parts of some stuff.

> Characterization 1. Basic constituents $\langle \underline{x}_1,\ldots,\underline{x}_n \rangle$ of $\underline{u}$ are in *structural interaction* $\underline{R}$ only if: $\langle \underline{x}_1,\ldots,\underline{x}_n \rangle$ belong to (some) stuff; $\underline{x}_1$ is in a specifiable position with respect to $\langle \underline{x}_2,\ldots,\underline{x}_n \rangle$, and $\underline{x}_2$ is in a specifiable position with respect to $\langle \underline{x}_1,\underline{x}_3,\ldots,\underline{x}_n \rangle$, etc.; and the specifiable positions of $\langle \underline{x}_1,\ldots,\underline{x}_n \rangle$ account for properties exemplified.

It has been established that the basic constituents belonging to stuff interact with each other and these interactions can have felt repurcussions at the micro-level. Of

greater interest, however, is the degree to which these structural interactions affect the properties exemplified by the stuff to which they belong.

At this juncture a change of stance must be made. Up to this point the center of discussion has been an unspecifiable and indeterminate stuff which could best be understood as "the stuff from which everything whatsoever is made." It is now essential to go beyond this perspective for the purposes of explaining property-exemplification in actual substances, and how such properties will differ for different types of substances.

To accomplish this explanatory task concerning property-exemplification the notion of an element will be called upon. In this case, an element is just an element of the periodic table, such as gold, uranium, helium, lead, and the like. An element is some stuff which has been marked out naturally and exemplifies properties that other elements cannot exemplify. Moreover, scientific theory has grouped any and all examples of elements together into taxonomic units because of their shared features.

> Ch. 2. Any s is element E only if: s is some stuff with basic constituents in structural interaction R; the most explanatory comprehensive true scientific theory groups s together with a set of arbitrarily selected normal exemplars of element E on the basis of their shared specifiable features; and if there is any stuff t with basic constituents in structural interaction R, then t is the same element E as s.

Elements, then, are a means by which we can differentiate groups of stuff which share property-features. It has yet to be demonstrated why these groups do share such features. Before this aspect can be spelled out explicitly further notions are needed.

Historically, one of the commonest metaphysical expressions has been 'substance'. This notion received numerous definitions in the grips of various philosophers. But it is not a term without some intuitive power behind it; hence, I intend to employ the term in my presentation. The following characterizations will work towards this purpose:

> Ch. 3. Any u is an elementary substance only if u is (some) stuff and u is element E.
>
> Ch. 4. Any v is a compound substance only if v is (some) stuff and v is two or more elements $\langle E_1,\ldots,E_n\rangle$ in definite proportions.

The notion of an elementary substance is straightforward. Examples of such would be gold, silver, radium, and any single element of the periodic table. It is necessary to give some explanation of what compound substances are. First, a compound substance results from the combination of more than one element. These elements are brought together in a certain manner, or definite proportion, which affects the type of compound substance that it is. For example, water (H_20) is a prime example of a compound substance in which the elements of hydrogen and oxygen coexist in a certain definite proportion, i.e., two parts hydrogen to one

part oxygen. While the elements can remain the same elements, their definite proportions can be changed, for example into H_30, with the resulting compound substance (H_30) being a new and different compound from the previous one (H_20). Hence, we would expect these different compounds to exemplify different properties although they obviously might share some.

The notion of substance simpliciter covers both Ch. 3 and Ch. 4. As such, substances are determinate in the sense in which stuff must be indeterminate. We can break substances up into different classificatory groups: compound, elementary, gold, salt, and so on. With stuff no such demarcations are possible since there is just stuff. Hence, the appearance of discussion about substances marks a move towards a more substantive examination of the status of physical objects. Substances are the specifiable stuff from which physical objects are made. However, this assertion turns out to be far from trivial. In the move from stuff to substance we enter a realm in which more specific roles can be defined for basic constituents. As a consequence we will be able to explain features, such as property-exemplification, central to understanding what physical objects are.

It is now possible to explain how the structural interactions between basic constituents mark out different elements and hence different substances. The discussion in

the following Sections will focus solely upon elementary substances. The investigation into compound substances will take some modifications although generally will follow the same track.

Any one substance $\underline{\mu}$ of element $\underline{E}$ will exemplify a set of properties which no substance of an element other than $\underline{E}$ exemplifies. This complex picture can be spelled out in greater detail by characterizing the nomic relationships between basic constituents in structural interactions, substances, and sets of properties.

> Characterization 5. Necessarily (de dicto) certain Laws of Nature $\underline{A}$ determine that whenever basic constituents $\underline{\phi}$ of substance $\underline{\mu}$ are in structural interaction $\underline{R}$, the Laws $\underline{A}$ cause substance $\underline{\mu}$ to exemplify the set of properties $\underline{P}$.

Ch. 5 sets out an intricate pattern of relationships and uses many notions. It also opens up many questions: which laws of nature are we talking about, in what sense do these laws "cause" the exemplification of certain properties, and just what properties of interest are being exemplified?

One must take a reasonably open-ended stance about what laws of nature are specifically being talked about. Generally, however, we can say that our interest is in those laws which account for an object's micro-structure. There are certain laws which account for why or how an object has the micro-structure that it does. What constitutes an atom of gold being an atom of gold is the satisfaction of a certain

physical description. The properties P discussed in Ch. 5 are deducible from structural descriptions at the object's origin plus this relevant sub-class of natural laws. The kernel of Ch. 5, or what can be termed substance-constitution, is that it follows (in terms of de dicto necessity) from structural properties plus certain distinguished laws of nature which govern micro-structural behavior that an object exemplifies a certain class of properties. It should be realized that if any substance v has these properties P then v is the same substance as μ. This is consistent with the notion that an element is associated with a set of properties which no other element shares exactly. Admittedly, much of this discussion retains an air of generality which philosophers often find disquieting. However, the intuitive backing to Ch. 5 seems solid. It makes great sense to explain certain properties of substances via the interrelationships between micro-structural descriptions and distinguished laws of nature the structure satisfies qua that structure.

Ch. 5 raises questions about the status of laws of nature. Are laws of nature necessary? Yes, I would answer, but in the following sort of way. It is a contingent fact that a certain group of basic constituents ever got together to form, for example, iron. To say that this is contingent is to say that we can imagine the world being different in such a way that the basic constituents never attained the structural interaction which results in iron. If the world

had been different in that manner then iron would never have existed. However, given the fact that we do have iron, it is necessary that iron have the properties that it does have. In this fashion can we accurately say that laws of nature are necessary. Kripke recognizes this self-same point and is quite forceful in pushing it:

> ...this would not be a case in which possibly gold might not have been an element, nor can there be such a case (except in the epistemic sense of 'possible.') Given that gold is this element, any other substance, even though it looks like gold and is found in the very places where we in fact find gold, would not be gold...such statements representing scientific discoveries about what this stuff is are not contingent truths but necessary truths in the strictest possible sense...Any world in which we imagine a substance which does not have these properties is a world in which we imagine a substance which is not gold...It will therefore be necessary and not contingent that gold be an element with atomic number 79.[5]

The core idea behind Ch. 5 and this discussion about necessary laws of nature can be expanded by setting out two important related features; namely, causal necessity and necessary properties.

The foregoing discussion facilitates a characterization of the notions of causal necessity and necessary properties which are very central to the delineation of original$_4$ properties.

Ch. 6 — The basic constituents ϕ in structural interaction R coupled with distinguished laws of Nature A necessarily cause substance ψ to exemplify a set of properties P.

Ch. 7 — The necessarily caused set of properties P exemplified by substance ψ are necessary properties P of substance ψ.

It is somewhat problematic to specify, for example, exactly which properties of gold are necessary. Such properties as chemical properties and thermo-conductivity certainly seem likely candidates for necessary properties. So too does the property of ductility, although this is somewhat less certain. Certain laws of nature are such that whenever the basic constituents (of gold) are in a certain structural interaction, the substance will exemplify certain chemical and thermo-conductive behavior, along with other possible necessary properties. Inasmuch as these properties are what we have called necessary properties, gold could not have failed to exemplify these properties. Some might argue that gold could fail to exemplify such chemical behavior; that it is not in any sense necessary that gold exemplify this behavior. Those who claim that they can imagine the circumstances in which gold does not so act chemically are confusing the hypothetical circumstance in which a substance <u>other than</u> gold fails to have such chemical behavior, with the putative but impossible circumstance of gold not possessing such behavior.

Where has this prolonged discussion come from and gone to? The entire investigation of substance-constitution and necessary properties arose during an attempt to more clearly demarcate original$_4$ properties. As mentioned before, the original$_4$ properties seem to be the set of essential properties contemplated by Kripke in his search for essential properties. As delineated within this Chapter, original$_4$

properties include internal structural properties, external hereditary properties, and (causally) necessary properties in the sense just spelled out.

Is Kripke on target in his assessment of these properties as comprising an object's essential properties? That is the task undertaken in the next Chapter where the viability of these four groups of original properties as essential properties is scrutinized.

CHAPTER VI

ESSENTIALISM

The last Chapter set out a variety of positions concerning what class of original properties might be considered essential to an object. That discussion is extended in this Chapter by deciding what original properties are original essential properties of an object.

In order to properly follow the investigations of this Chapter, a distinction must be pointed to, although extended discussion of it occurs later in this Chapter. There are two types of essences, or sets of essential properties which we want to search for. One type, which can be called original essential properties, focus upon timeless questions concerning necessity. Picking out these properties answers the questions regarding what timeless properties an object could not have failed to have. In this Chapter, the search is for these original essential properties. The other type of essence probably comes closer to the traditional notion of essential properties. Pointing to such essential properties answers the temporal question concerning what properties an object must retain if it is not to cease to exist. In part, my analysis of persistence can be seen as an attempt to provide an answer to what properties are temporal essential properties.

In the beginning of this Chapter, the focus is on original essential properties and whether any of the groups of original properties delineated in Chapter V fit this description. Later in the Chapter, the discussion is expanded to consider the issue of temporal essential properties.

Which interpretation of origin is most plausible for the necessity of origins thesis? Certainly, the entire class of original$_1$ properties is too broad, and at least some of these properties cannot possibly be considered essential to an object. The most obvious original$_1$ properties which seem inappropriate as original essential properties are the spatio-temporally indexed properties. Is it an essential feature of a statue's coming into existence that it was created in a particular studio on 19 October 1956? Considering such spatio-temporal historical beginnings of the statue, are these elements essential features of the object? That is, can we imagine the world being different in such a way that the statue was made in a different place and at a different time? Quite clearly, we can. The historical beginnings might be important if we want to construct a biography of that statue. But this information does not constitute an essential feature of that statue.

By saying that these spatio-temporally indexed original$_1$ properties are not essential, we are claiming that

an object might not originally possess these properties in every possible world in which the object exists. If the statue had been made on 20 October 1956, ceteris paribus, it would still be the same object. Likewise, if the statue had been made in a different location, it would be the same statue as long as the same materials were used to build it. In either of these respects the world might have been different. Accordingly, this is just another way of asserting that the historical spatio-temporal beginnings of an object are not essential. Consequently, the broad class of original$_1$ properties is too large and does not constitute an object's essential original properties.

Should all of the original$_1$ properties be ruled out for the purpose of the necessity of origins? No. There are some relational properties, other than the spatio-temporally indexed properties just examined, which do look like original essential properties. What are some examples of such relational properties? Two such groups would be the external hereditary and internal structural properties delineated in the last Chapter. These properties are clearly relational, thereby falling under the extension of original$_1$ properties.

Why do we think that the world could not have been different with respect to an object's external hereditary properties? Kripke presents the most persuasive argument on this:

> Let's suppose that the Queen really did come from these parents. Not to go into too many complications here about what a parent is, let's suppose that the parents are the people whose body tissues are sources of the biological sperm and egg...Can we imagine a situation in which it would have happened that this very woman came out of Mr. and Mrs. Truman? They might have had a child resembling her in many properties. Perhaps in some possible world Mr. and Mrs. Truman even had a child who actually became the Queen of England and was even passed off as the child of other parents. This still would not be a situation in which this very woman whom we call Elizabeth the Second was the child of Mr. and Mrs. Truman, or so it seems to me. It would be a situation in which there was some other woman who had many of the properties that are in fact true of Elizabeth... But what is harder to imagine is her being born of different parents. It seems to me that anything coming from a different origin would not be this object.[1]

Kripke draws the conclusion that external hereditary properties are essential. As mentioned before, this conclusion seems quite straightforward for biological organisms, where the external hereditary property is "parentage"; in those cases there is a clear sense of biological development resulting from the union of the egg and sperm. But are there external hereditary properties which are essential to non-biological objects such as tables?

As discussed in Chapter V, I concluded that there is an analogous sense in which these objects do have external hereditary properties of interest. In biological cases, the sperm and egg must come from the parent. Likewise, in non-biological objects, the object needs to come from the material it does come from. The oak chair in my room

must come from the particular oak tree in Northern Michigan that it did come, just as the fused zygote that I once was must come from my parent's sperm and egg.

If one reads Kripke carefully, what interests Kripke is that a particular bit of matter, the sperm and the egg, fuse. Correspondingly, he is interested that a particular object is made out of a certain piece of matter. It might appear that there is an assymetry between the biological and non-biological cases because the former clearly involve donors and a certain process which we do not associate with a table coming into existence. However, I believe that we must talk about donors in both types of cases. Just as we have tissue from people that go into the zygote, so too do we have tissue from a tree (or whatever) which goes into the chair or table.

What is the outcome of this discussion? We must conclude that external hereditary properties, such as the ones discussed above, are original essential features. What is of central importance in all of these cases is that the object must have its beginning in a certain hunk(s) of matter.

The other relational original$_1$ property picked out as being essential are the internal structural properties. This seems reasonable given the constituent ontology set out in the last Chapter. There are relational properties of an object's (significant) proper parts which seem

essential. For example, the properties defining the structural interaction and arrangement of the atoms in a specific molecule would fit such a schema. If a particular object is made out of a certain substance, it is a necessary feature of that substance that the basic constituents be in a certain structural pattern. As such, these relational properties must be considered essential to the object's origin. It seems slightly awkward to claim this, but it is a consequence of the constituent ontology set out.

The statement just made is too strong. There are certain features of internal structural properties which have not yet been satisfactorily explicated. The proper parts of an object must fit together in an appropriate fashion which is governed by the relevant sortal for the object. Moreover, at different levels of looking at any object, that is as we look at more micro-parts, we will continue to encounter the way in which sortal terms govern such configurations.

Consider a stereo at its beginning. We won't have a stereo if we have all the correct proper parts just put together in an arbitrary manner. Rather, associated with the stereo's beginning is a structural description of how the parts must fit together, and this description must conform to the demands of the sortal 'stereo.' There are properties associated with this sortal such that if the

object has them at its origin, it will possess these properties at all times.

Will these regulatory sortal terms be invariant? Of course, some variation will be allowed. Such variation will be governed by the shifting requirements imposed by different sortal terms with which the object is associated. As long as the structural pattern is such that the object consistently falls under the relevant sortal term, this feature of the internal structural properties is preserved.

Someone might argue that these properties, if they be considered original essential properties, deviate from the properties usually considered essential. The deviation, it might be argued, is that these properties are not _de re_ essential properties, but rather a hybrid _de dicto_ essential property--whatever that might be. This argument might claim that the necessity resides in the description, not in the object itself apart from its designation as a stereo. However, this argument seems to miss the point. These properties are _de re_ in the sense that the object _de re_ satisfies the sortal 'stereo'. In so satisfying this sortal term, certain structural features about that object are fixed in the manner traditionally associated with essential properties. Consequently, it does not seem outrageous to claim that internal structural properties, when construed in this broad fashion, are essential properties--of the type that we are in search of.

What conclusions can be drawn about the necessity of original$_1$ properties? Not all relational original$_1$ properties are necessary, and we want to rule out such properties when they are spatio-temporally indexed. Following Kripke, however, we concurred that a subset of relational original$_1$ properties are essential; namely, the internal structural and external hereditary properties. What about other properties, such as qualitative properties, which fall within the extension of original$_1$ properties? They too might seem essential, but that problem will be investigated under the remaining original properties, where the attempt to spell out the notion of qualitative property is undertaken more vigorously.

Given our conclusions about original$_1$ properties, we can skip original$_2$ properties since they covertly allow a type of spatio-temporally indexed property to be essential. The examination of whether purely qualitative original properties are essential grows naturally out of a discussion of original$_3$ properties, to which we now turn.

Original$_3$ properties exclude all relational properties. Given the fact that some original relational properties are essential, it is clear that the class of original$_3$ properties fails to provide a thorough classification of those original properties which are essential. There remains the question about qualitative properties, properties which do not make reference to other existing individuals.

Let us momentarily consider my 1975 copper colored Toyota. Certainly the property of 'being copper colored' is a purely qualitative property. Furthermore, suppose that this is the original color of the car. The pertinent question arises concerning whether this original$_3$ property of 'being copper colored' is essential to my car. Is my Toyota originally copper colored in every possible world in which that car exists? Reflect upon the following. Could we imagine the world being different in this fashion: as my car went down the assembly line at the factory they ran out of copper paint, and in order to avoid a long delay, they switched to a blue colored paint. So, that car would have been painted blue instead of the copper as they had planned. If the world could have been different in this manner, then the purely qualitative property of 'being copper colored' is not essential to my car. Clearly, the world could have been different in this fashion; there appears to be no reason to doubt otherwise.

The finding that such original$_3$ properties as 'being copper' are not essential should not come as a surprise when we closely examine Kripke's position, which we seem to be following. As the discussion of original$_1$ external hereditary properties pointed out, Kripke's position is that the central element in the necessity of origins is the hunk of matter in which the object originates. Kripke's stated belief is that if a material object has its origin

in a certain hunk of matter, it could not have had its origin in any other hunk of matter. Back to the question before us, the property of 'being copper colored' is an accidental feature of being a particular hunk of matter. That hunk of matter could have been any color. Kripke's concern is with features intrinsic to the hunk of matter, such as certain structural features of the matter. But the property of 'being copper colored', we might crudely say, rides piggy-back on these matter or substance-related features. A piece of wood is the same piece of wood whether it is painted red or green. Accordingly, the purely qualitative property regarding color is certainly not an original essential property of an object.

Does this mean that no purely qualitative properties are original essential properties? Those properties aligned with original$_3$ properties do not seem to be essential. However, there is a subset of qualitative properties, picked out by the class of original$_4$ properties, which might fulfill our needs on this score. The lesson learned above seems to be that original properties which are "intimately connected" with the hunk of matter from which an object originates might be essential to the object. The trick becomes one of trying to cash out this suggestion. How could we demarcate this set of properties? By looking to the qualitative properties allowed in as original$_4$ properties which grow out of the constituent ontology developed in Chapter V.

The original$_4$ properties we are interested in are the object's (causally) necessary properties pinpointed in the constituent ontology. In other words, if a statue has its origin in a particular hunk of gold, the necessary properties of the substance 'gold' will be the original$_4$ essential properties of that object. Involved in this pronouncement is a metaphysical principle which could be called the Principle of Transference. The compositional properties of the matter from which an object is made "transfer" as original$_4$ essential properties to the object. Accordingly, in any world in which the gold statue comes into existence, the necessary properties of gold, whatever they might turn out to be, will be original$_4$ essential properties of the statue in that world.

It appears as though our hunt for an exhaustive class of original properties is over; the search has ended with original$_4$ properties. The conclusion of this investigation, if this be our conclusion, is that original$_4$ properties are essential. This class includes the relational properties termed internal structural and external hereditary properties and it also includes the qualitative properties known as (causally) necessary properties which come from the constituent ontology.

Are we satisfied with the conclusion that original$_4$ properties are essential to objects? No! There is a grave problem with the attempt to claim that the (causally)

necessary original properties of an object are essential. What is wrong-headed is that such a claim confuses causally (or physically) necessary properties with metaphysically essential properties, the latter being our interest in the search for original essential properties. It is a mistake to try and link essentialism with the existence of certain physical laws, since it seems easy to imagine a world in which the physical laws of the actual world do not hold.

If one wanted to try and allow such (causally) necessary properties to count as original essential properties, one could go (at least) one of two routes: (1) we might rule out those possible worlds where the physical laws deviate from the physical laws of the actual world. We might think that there are certain constraints on possible world "construction". Accordingly, there can only exist possible worlds which have physical laws consonant with those of the actual world. The problem with this "solution" is its inability to solve anything. There is no reason to just rule out of court possible worlds in which the physical laws of the actual world are different. Hence, this avenue of retreat seems very ineffectual.

(2) The second move is more sophisticated, but very difficult to articulate and defend. The Kripkean position that the hunk of matter is essential to the object's origin places a premium on the identity of micro-physical constituents. Since there is the same hunk of matter from

which the object originates in every possible world in which the object exists, we might make the following move which resembles a move initiated in Chapter V. We could say that unless we assume that our actual physical laws obtain in other possible worlds, it makes no sense to identify micro-physical constituents across possible worlds. Would it make sense to imagine an electron existing in a world where electrons don't repel each other? Perhaps not. Since electrons having these and other properties involve certain laws which hold in our world, there couldn't be electrons at all without such laws existing. Hence, the identity of micro-physical constituents presupposes that certain physical laws hold for all possible worlds in which they exist. The relevant physical laws in question explain the sorts of structural interactions that are essential to the object.

This type of response, given in (2), opens the door to some of the ugliest problems in the philosophy of science. What laws must hold for us to speak intelligently about electrons in other possible worlds? The attempt to pinpoint such a set of physical laws is notoriously problematic. The "old school" on this topic believes that electrons, for example, are defined by a system of laws which hold in the best physical theory. The old school has been challenged by Putnam and others who claim that electrons are not identified by any such laws at all, but

rather by our having direct access to their effects. Such a position, which includes a causal theory of reference component, believes that the definition of 'electron' comes from electrons producing such and such readings on detection equipment. So Putnam, contra the old school, argues that such physical laws are not necessary for us to intelligently identify micro-physical constituents across worlds.

It appears as if we must follow the "old school" if we are going to make the claim about certain physical laws holding across worlds. But such a move is beyond the scope of this modest project, and also terminally problem-filled. Even if we followed the old school's route, is that any guarantee that we would get the physical laws we need to turn the (causally) necessary properties into original essential properties? It seems not. Consequently, I will assume that the attempt to claim that (causally) necessary properties are original essential properties is doomed to failure, since physical laws are probably not necessary in the required sense. We can imagine a gold statue coming into existence in the actual world with necessary properties; but these properties are "necessary" in the sense that they exist in every possible world in which these laws, and therefore the substance 'gold' exists. However, there is no reason to believe that this statue could not exist in another possible world, made out of the same stuff and micro-physical basic constituents,

but exemplify different "necessary" properties because of the different physical laws operative in that world. Since the substance in that world did not exemplify the necessary properties of gold, that substance would not be gold (this is Kripke's message), although it would be the same stuff--that is, the same micro-physical structural system of basic constituents.

It appears that the class of original$_4$ properties fails to provide us with a complete class of original essential properties. What remains from this group, however, are the internal structural and external hereditary properties. Let us create a new class of original$_5$ properties which contains the relational properties of internal structural and external hereditary properties. What must be made explicit is the claim that the hunk of stuff from which an object is made is essential to the object. Accordingly, let it be reiterated that external hereditary properties have this characteristic of being related to the matter from which the object is created. Another way to think of external hereditary properties is as "stuff properties", which points to the property of 'being made out of a certain hunk of stuff.'

The class of original$_5$ properties contains internal structural and external hereditary properties. These properties characterize an object in every possible world in which the object exists. This class of original$_5$

properties makes no reference to physical laws, to spatio-temporal locations, or to accidental qualitative features of objects. The extension of essential original$_5$ properties centers around the stuff from which an object is made, around the object's micro-physical structure, and around the object's relation to certain sources of stuff such as parentage (if any). All of these original$_5$ properties, except the structural properties, can be seen as a consequence of the Kripkean thesis, accepted and modified here, that if a material object has its origin from a certain hunk of stuff, it could not have had its origin in any other piece of stuff. The project up to this point can be seen as an attempt to determine what Kripke's thesis amounts to, and an attempt to see exactly what original properties are compatible with the necessity of origins thesis. The judgment of this section is that original$_5$ properties are essential to an object. Such properties, descriptive of an object's origins, characterize an object's origin in every possible world in which the object exists.

The type of "essence" captured by original$_5$ properties is a particular type of essence which ought not be confused with any other notions. Kripke forcefully drives this point through. The essence just characterized offers an answer to the following question:

> (i) What (timeless) properties could the object not have failed to have, and what properties could it have lacked while still (timelessly) existing?

This question does not concern time but rather focuses upon necessity and what strictures are placed upon an object's (timeless) origin. But it is very easy to confuse this type of question and answer about the necessity of origins with the principle that the substance of which an object is made is essential to it. However, this principle, if correct, is concerned with time and not the type of necessity that (i) is. Accordingly, such a principle would be an answer to the following question:

> (ii) What properties must an object retain if it is not to cease to exist, and what properties of the object can change while the object endures?

Question (ii) concerns problems about whether an object can have all of its parts replaced, or whether the wooden lectern could turn into ice. But these are different problems than those encountered when examining question (i), and we must be careful not to confuse the two types of essence involved.

Question (i) has been answered by the foregoing discussions. The properties that an object could not have failed to have are the object's original$_5$ properties. Now, even though question (i) and (ii) are independent, does this answer to (i) give any insight into the type of answer we would want to give to (ii)? In and of itself, we must say "no". One could easily adopt our response to (i), that original$_5$ properties are essential, without endorsing any particular point of view regarding what temporal

changes an object can undergo. Someone who believes that all parts of an object can be replaced over time, and someone who opposes that view point, could both agree that $original_5$ properties are essential, although of course they need not.

Although our answer to question (i) does not provide an answer to (ii), the former in conjunction with my analysis of the persistence of physical objects does point us to an answer to question (ii) concerning whether or not an object's substance is essential to it. Of course, as is readily apparent, my analysis only says that within a world an object must retain a particular set of properties. Consequently, any attempt to use my analysis to give an answer to question (i) would be doomed to failure, since it does not follow from my analysis alone that an object may not have different origins in different possible worlds. However, the task completed in the first section of this Chapter does place certain restrictions upon the origin of an object: we now see that an object must have the same $original_5$ properties in every possible world in which that object comes into existence. Given this constraint, we can look at a particular object in a world and use my analysis to monitor the extent to which $original_5$ properties can come and go after the object's origin. Through this type of examination we will get some insight into the type of essence indicated by question (ii) above.

The relevant question concerns what changes an object can undergo through time and within a world. From the preceding investigation, we know that an object's original$_5$ properties are essential. Consider a gold statue which has just been created. On the above account, that statue would possess a certain set of original$_5$ properties in any world in which it comes into existence; such properties as the external hereditary property of being made out of a certain hunk of stuff, and the object's internal structural properties. As Kripke would say, this statue could not have had its origin in any other hunk of stuff than the piece of gold in question.

Setting these considerations aside for the moment, let us return to my analysis of persistence. Given a gold statue within a world, we use my analysis to determine what succession of object-stages constitutes the history of the single gold statue. My analysis stipulates that change can occur to an object. There can be change within the object's significant proper parts up to a point set by the relevant maximal sortal for that part. If the change goes beyond that point, identity is ruptured. Again, the amount of change is fixed by the conditions of the original ancestral stage of the object. After that stage is pinpointed we proceed through the complete ancestry of stages partitioning histories on the basis of their divergence from the identity parameters set by the original ancestral stage.

We will now apply my analysis to the gold statue which exists at time t in world w. We trace out a complete ancestry of that statue in w. This is accomplished simply by following the dicta of my analysis. At some time earlier than t, after tracing through the stages via local full diachronic linkage, we will finally come upon the statue's original ancestral stage. Then, in accordance with the second step of my analysis, we "turn around" and trace forward in time, partitioning histories of the statue in this complete ancestry on the basis of the continuation of global full diachronic linkage. The bookkeeping tau-function records the number of histories partitioned, be it one or many. Through the application of my analysis to the statue in w, we eventually obtain a clear and concise picture of the statue's ancestry and history. But we now realize that once the original ancestral stage of the statue has been pinpointed, we can pick out certain features of that original stage which are essential to the object. That is, the original$_5$ properties of the statue's original ancestral stage are essential to the statue, and it will possess these properties in every possible world in which it comes into existence.

The question now becomes, can the statue shed these original$_5$ properties while still remaining the same object? Again, this is a temporal question, and therefore it concerns a different type of essence than the timeless questions

concerning the statue's origin. The temporal question concerns whether the statue's substance is essential to the statue. Even though my analysis only dictates identity criteria for an object within a world, we can draw some conclusions given our knowledge of the necessary features surrounding an object's origin. Take the statue, in a world w, with its original$_5$ properties which are essential. In any such singular world, my analysis will yield the same result: namely, in order for the statue to remain the same object within w, there must be continuity of identity in the object's significant proper parts. How is such continuity of identity monitored? By demanding that successive stages be made up of the same stuff or substance, especially for the significant proper parts. If the statue remains the same object over time on my analysis, this implies that the statue has retained the stuff of its significant proper parts. This, in turn, implies that the statue has retained its original$_5$ properties. If the statue goes out of existence at some time according to my analysis, there has been too great a change in the statue's significant proper parts. This means that the original$_5$ properties of the statue are no longer prominent in the fashion necessary for transtemporal identity.

Does my analysis monitor the continuity of an object's original$_5$ properties? Not entirely, it would seem. My analysis does not consider possible facets of what we have been calling external hereditary properties, not explicitly

at any rate. If a causal requirement were inserted into the analysis, which I have not done but have left the door open to, then certain more obscure external hereditary properties would be given some role in the analysis, or so it seems. Nonetheless, it does not seem distressing that the analysis fails to monitor this type of relational property of the object because it doesn't make sense to talk of an object losing such properties. What we concluded was that the real concern here was with "originating in a certain hunk of stuff." On this regard, then, my analysis clearly does regulate such features and the extent to which they can change over time.

Does my analysis of persistence, when conjoined with our conclusions that original$_5$ properties are essential, affirm the thesis that an object's stuff (or substance or matter) is essential to it? Not exactly, because of the "significant proper part" aspect of my analysis. There are two ways in which we could venture at this juncture. (1) On the one hand, we could modify the necessity of origins thesis so that only the original$_5$ properties of an object's significant proper parts are essential to an object, rather than saying that the original$_5$ properties of all of the object's proper parts are essential to it. Then, we would claim that just those original$_5$ properties which are essential at the object's beginning (i.e., those belonging to the object's significant proper parts) must be

retained throughout the object's life in order for the object to remain self-same. On this picture, we would find the following situation. Consider a watch which exists in worlds w and w'. In both worlds, the watch's significant proper part, the 'watchhead', has exactly the same original$_5$ properties (this gets into troubles with transworld identity, but for the moment suppose that we know the two heads in w and w' are the same). However, the watch in w has a different watchband than the watch at w' at the time of origin. In each world, after the time of origin, the constraints would be the same vis-a-vis my analysis: the watch's significant proper parts, which are the same in w and w', would have to retain their original$_5$ properties in order to retain their identity. (2) The other alternative picture is to claim that the original$_5$ properties of all of the object's proper parts are essential to it. However, in order for an object to remain the same object within a world, it is only necessary that the object's significant proper parts retain their original$_5$ properties.

It appears that options (1) and (2) vary with respect to which proper parts' original$_5$ properties are essential at the time of an object's origin, but have the same requirements for what can happen to an object after it comes into existence. On what basis would we choose between (1) and (2)? Since it doesn't appear as though the topic before us will settle this, it appears that the problem of transworld identity might push us towards either (1) or (2).

We might prefer the picture given by (2) where all of the object's original$_5$ properties are original essential properties rather than restricting it to the significant proper parts. This problem will be settled in Chapter VII on transworld identity.

This digression aside, what conclusions can be drawn about the claim before us? On the separate timeless question of (original) essential properties, we concluded that at the very least the original$_5$ properties of an object's significant proper parts are original essential properties. Moreover, the right is reserved to push this feature to all of an object's original proper parts. Given this feature, and my analysis for persistence within worlds, we can answer Kripke's temporal question: an object must retain the stuff or substance (of its significant proper parts) in order for the object to retain identity through time. This translates out to saying that within a world, an object's significant proper parts must retain their original$_5$ properties, and this can be monitored by my analysis of persistence. Consequently, it is true that an object's stuff or substance is essential to the object, with the restriction that we must limit this claim to the object's significant proper parts. This modification of Kripke's thesis might make it toothless. However, I think not, since it does make some claim about another essential feature of objects. I want to make it explicit that this

result does not, and can not, follow solely from my analysis of persistence. However, given the independent judgment that an object's original$_5$ properties are original essential properties, my analysis in conjunction with that finding gives the conclusion just announced: throughout the history of an object, an object's significant proper parts' original$_5$ properties are essential to the object.

CHAPTER VII

TRANSWORLD IDENTITY

A topic of great debate within contemporary metaphysics concerns the problem of transworld identity. This Chapter investigates that problem within the context provided by Chapters V and VI. It might seem inexplicable that this topic has been kept out of view this long, especially given the investigations about essential properties in the preceding Chapters. However, the claims made about essentialism in those areas were offered independently of any criteria for identifying objects in different possible worlds. There is a great benefit in proceeding in that manner, since the results of those Chapters will help us better understand how to identify objects in other worlds.

This Chapter begins with an inspection of some recent moves by philosophers on the topic of transworld identity. It is not exhaustive, but hopefully conveys the attitudes prevalent among philosophers on these issues. The remainder of the Chapter is taken up with constructive attempts to say something substantive about how we identify objects across worlds. Employing aspects of my analysis and findings about essential properties, suggestions are offered about how to construct such a criteria. Although the findings are not conclusive, they go some of the distance.

What is the problem of transworld identity? Its source can be found, to a large extent, in the debate generated by

the topic of essentialism and possible worlds. Someone might assert that Jimmy Carter possesses certain essential properties, that is, properties which he has in every world in which he exists. This claim gives rise to the controversy. How might one explain this assertion about Carter? It seems entirely plausible to suppose that the same man Carter exists in various different states of affairs. For example, there is the state of affairs consisting in 'Carter's being a plumber'; although possible, this state of affairs does not actually obtain. But it is natural to suppose that if it had obtained, Carter would have existed and would have been a plumber. Furthermore, one even supposes it impossible that this state of affairs obtains and Carter fails to exist. If this be so, however, it follows that Carter exists in this state of affairs. This chain of reasoning soon leads to the conclusion that Carter, if he exists in this state of affairs, exists in every possible world including it, in which he exists. As such, Carter exists in many possible worlds.

The above characterization commands much criticism, not only from philosophers who find the entire "possible worlds" notion without backing, but also from philosophers who otherwise endorse the use of "possible worlds" constructions. These latter philosophers hold to a view called the "theory of worldbound individuals" (WBI), the position that each object exists in at most one world.

Prior to going on with this discussion, something should be said about what possible worlds are like, if one is willing to embrace them. Quite simply, a possible world is a maximal possible state of affairs. To explicate this further, the notions of "inclusion" and "exclusion" must be set out:

S includes S' $=_{df.}$ Nec.(S is actual$\rightarrow$S' is actual).
S excludes S' $=_{df.}$ Nec.(S' is actual$\rightarrow\sim$(S is actual)).

A possible state of affairs S is maximal just in case for every possible state of affairs S', either S' is included in S or S' is excluded by S. But are we ever assured that there is a maximal possible state of affairs? Certainly, because we are in one. The actual world consists in the sum of all states which actually obtain. We can understand what it is for objects to exist in such maximal possible states of affairs as follows:

x exists in w $=_{df.}$ Nec.(w is actual$\rightarrow$x exists).
o has P in w $=_{df.}$ o exists in w & Nec.(w is actual $\rightarrow$o has P).

In the following discussions, then, a possible world will be understood as a maximal possible state of affairs. Nothing crucial hinges upon the acceptance of this interpretation; it is offered as the most frequent manner in which possible worlds are explicated.

The thesis of WBI can be set out quite simply:

(1) any object o can exist in at most one possible world.

Supporters of WBI believe that it makes no sense to talk about the "same object" when we follow an object from

possible world to possible world. The theory answers all questions about the identity of object o in world w and object o' in w' in the same manner: the answer is always "no", they are not the same object. What this amounts to saying, for the most part, is that philosophers are driven to WBI because of the problem of transworld identity (TWI). Some believe the latter problem to be irresolvable although intelligible, while others flatly believe the entire problem to be unintelligible.

Extending this discussion, the problem of TWI can be delineated. Once again suppose that Carter exists in a world w' distinct from the actual world w; suppose that Carter was not Governor of Georgia in w'. Also, Carter might lack properties in w' which he has in the actual world w; he disliked softball, joined the Marines, and had a brother who is a minister. And, in w' he might have been six feet five inches tall with a beard, and so on. Confused, we now ask ourselves, how could we possibly identify Carter and pick him out in that world w'? Given the many entities in w', how could be decide which entity is Carter in w'? Clearly, it is argued, our criteria of "Carter individuation" in w would fail to individuate Carter in w'. The argument continues that if we cannot pick out Carter in w', then we do not adequately understand the claim that Carter exists in w'. Before such discourse can be intelligible, we must have a criterion which facilitates our picking our Carter from world to world.

The WBI position as expressed in (1) is supported by a number of arguments.[1] Typically, it is asserted that (1) is implied by the following claim:

> (2) to ascribe incompatible properties to any object o in w and w' is to make an inconsistent statement about o.

Since (2) implies (1), if (2) can be shown true then the principal thesis (1) for WBI will be established. On the face of it, however, (2) seems silly. Suppose object o in world w has property P while o in another world w' lacks property P (or has property $\bar{P}$). Is it the case that o has incompatible properties? No, o has $(P \vee \bar{P})$, and only one of them at a specific world. This can be further illuminated with a temporal analogy where object o has P at t and object o has $\bar{P}$ at t', where $t<t'$; again these properties are not incompatible.

Plantinga, in his book The Nature of Necessity,[2] argues against WBI and in favor of TWI. He believes that possible worlds consist of objects having properties and we can always ask if two possible worlds share objects or not. If P_w is the collection of all propositions describing a world w, Plantinga claims that: w contains object o if and only if P_w entails that o exists. But Plantinga's response here falls short, especially if one realizes that that the problem of de re necessity is equivalent to the problem of TWI. The very intelligibility of possible worlds construction depends upon the intelligibility of de re modality. The problem of characterizing de re modality can be reduced, in a sense,

to the problem of TWI. But given Plantinga's program of trying to justify de re modality, his claim above begs the question which asks about the meaning of these possible world constructions. Hence, the problem is that Plantinga's response fails to directly answer the question.

What kind of argument would suffice to establish the objector's position that in certain situations there is no fact of the matter whether x in w = x' in w'?; not that the claim is false, just no fact to the assertion that x = x'. Presumably, one must give a description which is complete across worlds and which does not distinguish x and x'. What type of descriptions might one give in order to accomplish this? Two candidates are (a) observational descriptions (i.e., empirical), and (b) qualitative descriptions. With respect to (b), Øx is qualitative just in case it doesn't involve reference to certain particular objects. The claim then vis-a-vis our problem is that even with a complete qualitative description of worlds w and w', we will not be able to distinguish x in w from x' in w'. This is an exceptionally strong claim since even all of the fundamental predicates of theoretical physics express natural kinds or are purely qualitative.

Although this is a strong claim it can be buttressed with the acceptance of a theory of meaning called "Limited Verificationism" (LV). Two postulates of LV read:

(1) If A has determinate truth-condition, then it is possible to know the truth-value of A given appropriate evidence E.

(2) E in (1) may be assumed to be qualitative.

Consider the following thesis in conjunction with (1) and (2):

> For all physically possible worlds w, there exists a world w' which is qualitatively indistinguishable from w, but which shares no physical objects in common with w.

For example, we might have two statues in w and w' composed of qualitatively identical but distinct fundamental particles. We must assume here that x in w ≠ x' in w' if they are not composed of the same particles. But, ex hypothesi, there is no qualitative evidence, so (1) and (2) are violated. It appears, then, that TWI is in trouble if we are willing to accept LV.

What is a possible response to this objection to TWI? Kripke, in such a stance, argues that the possible world "metaphor" is being taken too seriously in such an objection.

> What seems to be objectionable is that this depends on the wrong way of looking at what a possible world is. One thinks, in this picture, of a possible world as if it were like a foreign country. One looks upon it as an observer...A possible world isn't a distant country that we are coming across...A possible world is given by the descriptive conditions we associate with it...'Possible worlds' are stipulated, not discovered by powerful telescopes. There is no reason why we cannot stipulate that, in talking about what would have happened to Nixon in a certain counterfactual situation, we are talking about what would have happened to him.[3]

What does Kripke mean in saying that possible worlds merely exist by stipulation? That is hard to say. He might mean that possible worlds, by construction, are just objects existing in counterfactual situations where these situations are specified by stipulation. Then, we ask what would be the case if such and such were so. Furthermore, there are presumably "rules of stipulation", such as the restriction that we cannot stipulate an antecedent which is not possible. Then, you need a criterion of possibility to get Kripke's suggestion to work. In the end, when one asks what is solved by this appeal to stipulation in the problem of TWI, it is very hard to say. Near the end of this Chapter, Kripke's suggestive comments on this topic will be given further inspection to see if anything positive can be in them.

To round out this survey of the problem of TWI, we will consider a response offered by B. Brody.[4] His theory, which might be called "temporal essentialism", purports to reduce the problem of transworld identity to the problem of identifying objects across time. If such could be accomplished, that would be significant progress. It appears that Brody's program is quite ambitious; he wants to provide an account of TWI which conforms to the strictures of LV.

Brody's theory presupposes two abilities:

(1) It is possible to identify objects across time within a given possible world; and

(2) It is possible to identify existing things within the actual world.

These presuppositions seem reasonably sound. Within a world we can intelligently ask when two objects are identical at different times; namely, when my theory of persistence says they are. Brody then offers his solution in the following Principle:

(B) $\underline{x}$ (in $\underline{w}_0$) has $\underline{F}$ essentially if and only if $\underline{x}$ has $\underline{F}$ at all times in $\underline{w}_0$ and there is no world $\underline{w}'$ extending $\underline{w}_0$ from some time $\underline{t}$ at which $\underline{x}$ exists such that there is a time $\underline{t}'$ such that $\underline{x}$ exists at $\underline{t}'$ in $\underline{w}'$ and lacks $\underline{F}$ at $\underline{t}$.

How does (B) represent progress in the problem of TWI? We no longer have to identify objects across different worlds, but rather only consider alternative futures of the actual world.

Does Principle (B) work as Brody claims? No, his (B) has consequences which are too implausible. Brody will have problems with tensed-predicates which seem irresolvable. Consider the predicate 'being red at sometime', represented by $(\exists t)$(x is red at t). Is this an essential property according to (B)? Yes, it clearly is. Certainly this result is counter-intuitive. Another example of an essential property according to (B) is 'x is originally red', defined as: $(\exists t)(\forall t'<t)$(x does not exist at $\underline{t}'$ and x exists at $\underline{t}$ and x is red at $\underline{t}$). But as we concluded in earlier Chapters, it is questionable to suppose that this type of qualitative property is an original essential property. How could (B)

be patched up? The obvious move is to rule out "temporally-contaminated properties" as essential properties. But if we make this modification on (B) we will also be ruling out the original essential property 'x is originally made out of a certain hunk of substance', and we don't want to rule these properties out. Consequently, Brody's attempt to resolve the dilemma posed by TWI fails.

This discussion of TWI ends by coming to no firm conclusions. Reasons were offered which support the charge that WBI cannot sensibly be maintained. On the other hand, if one adopts a form of LV, it appears that TWI is in trouble and we are forced back to WBI. Whatever the case, the ensuing examinations will attempt to see what sense can be made of the entire problem of transworld identity.

The problem of transworld identity is thorny, as the above excursion through a variety of moves indicated. Can any sense be made out of this problem using results uncovered in Chapters V and VI? To some extent, the answer is affirmative. We will be able to reduce the problem of transworld identity to another more limited problem. Beyond that, there are a range of solutions which might be embraced, and these will be considered.

Where do we start in trying to determine when two objects in different possible worlds are identical? The following quote from Gibbard offers a fruitful suggestion:

> Once I made my statue, that statue existed, and nothing that happened from then on could change the fact that it had existed

> or the way it had come to exist. It would be that same statue whether I subsequently broke it, squeezed it, or sold it. Its origin, then, makes a statue the statue that it is, and if statues in different possible worlds have the same beginning, then they are the same statue.[5]

Gibbard would have us inspect origins and make our identity claims on comparisons of origins. It might appear from this suggestion that a solution to the problem of trans-world identity is close at hand for us, given that we know a great deal about objects and their origins. It might be thought that the following procedure, which takes off from Gibbard's proposal, finally brings the problem to a close.

Consider an object o in a possible world w. With respect to o at t in w, trace out a complete ancestry of o using my analysis of persistence. After some tracing, we will discover the original ancestral stage for object o in w; let us call that stage OAS(o). Using Gibbard's suggestion, we employ the following criteria: since we have pinpointed object o's origin in w, and since we know that an object's original$_5$ properties are originally essential, we will know that object o's original$_5$ properties at OAS(o) are originally essential. That is to say, we know that object o, in every possible world in which it comes into existence will have these same original$_5$ properties.

Suppose we want to know if object o' in world w' at t' is identical with o in w at t. As Gibbard said, they will be the same objects if they have the same origins. Using my analysis, we determine the original ancestral stage

for object o' in w'; call that stage OAS(o'). Then, we compare the original$_5$ properties of OAS(o) in w with those of OAS(o') in w'. If they share the same original$_5$ properties, then they will be the same identical objects. It appears, then, that using such implements which we have uncovered, we can provide a neat solution to the problem of transworld identity.

Unfortunately, the floor quickly falls out from underneath this simple solution. This move will be successful only if original$_5$ properties are uniquely individuating. In other words, if it is the case that when we pinpoint an original ancestral stage with its original$_5$ properties, this set of properties picks out one and only one object in that world, then the solution carries through. But are original$_5$ properties uniquely individuating?

The following case illustrates the failure of original$_5$ properties to uniquely individuate an original object-stage from other object-stages. Consider an artist who makes a clay statue from a certain mold out of a piece of clay which we shall call c. Suppose that right after the artist has made the statue out of c, he makes another clay statue using the same exact mold, but from a different piece of clay which we shall term c'. In this situation, the two statues would not be identical and they fail to share all original$_5$ properties (working on the hypothesis presented above). Each statue is made out of a different piece of clay,

so they possess different stuff properties. This case of unique individuation works within a world, where we can presuppose the ability to trace and differentiate different micro-physical constituents. Even supposing that this will always work within a world, the problem with this solution arises when we try to apply it to cases across different possible worlds.

Suppose we have statue s in world w made out of piece of clay c. In another world w', suppose we have statue s' which is made out of a piece of clay c'. The alleged criteria asks us to find these respective object's original ancestral stages and compare their original$_5$ properties. We can do this for s in w and for s' in w'. Imagine that the two statues are shaped exactly alike, so there is a similarity in their internal structural properties. Suppose that they were created by the same artist so that they share the same external hereditary properties, supposing that the maximal sortal 'statue' has a requirement concerning the creator of the statue. Since both statues are made out of clay, they both might share the same external hereditary (stuff) property.

Now suppose that in world w' the same artist makes another statue s'' out of a piece of clay which also appears to have the same original$_5$ properties as s in w. Although it would be possible for us to distinguish statue s' in w' from statue s'' in w', as we saw above, is there any way to

determine if statue s in w is identical to statue s' in w', or to s'' in w'? No, it would seem not. What allows us to differentiate s' from s'' in w' is the ability to tell their micro-physical constituents apart within that world. But we cannot yet assume that ability across possible worlds, since that is just the problem we are trying to resolve. This brief discussion seems to indicate that the problem is not that original$_5$ properties fail to individuate, but rather that these properties are sometimes non-qualitative. The argument is such that it might look like original$_5$ properties are not sufficient for individuating, but they are.

When we consider an object and what its original essential properties might be, we try to imagine how the world might have been different at the object's beginning, and whether that change would alter the object's identity. When we decide that a feature is originally essential, such as the object being made from a certain hunk of stuff, we are doing something different than identifying objects across possible worlds, which is the task presently at hand. Given a statue, the original$_5$ properties of that statue are essential; but there still remains the problem of how to track down an object in another possible world with that same origin. If that object exists in another possible world, then it will have those original$_5$ properties. The problem now, however, is to try and set up a criteria that will help us find those objects in other possible worlds, if they exist.

The upshot of this examination is that we now are faced with the problem of identity of original ancestral stages across possible worlds. If it were the case that original$_5$ properties were uniquely individuating <u>across</u> worlds, then there would be a clear solution. However, there is a great difference between saying that if an object has its origin in a hunk of stuff it couldn't have had its origin in any other stuff, and the ability to journey into another possible world and match up a hunk of stuff from that world with the hunk of stuff from the actual world. Perhaps the most haunting problem case for this procedure has not even been mentioned. What happens when the same hunk of stuff is used to construct different objects within a world. For example, a piece of clay might be used to construct a statue at a time, and then broken down, and used to build a different object later. Even if we could match up original$_5$ properties across worlds, what would we do about cases such as this? Consequently, for the time being, we must be content to see how the problem now needs to be attacked, without being able to carry out the full resolution.

Prior to a discussion of how we might identify original ancestral stages across possible worlds, it is not quite sufficient to say, as Gibbard does, that the origin is all that counts in determining transworld identity. There is more to it than that, and this additional feature can be cleared up using tools already at our disposal, such as my

analysis of persistence. For the sake of this investigation, let us suppose that we do have the ability to identify original ancestral stages across worlds. That is, suppose that we have a procedure that tells us when OAS(o) in _w_ = OAS(o') in _w'_. Some might believe that once we have established this, we have answered the question of whether or not _o_ in _w_ = _o'_ in _w'_, but that is not so.

We will adapt the Ship of Theseus case to the problem at hand. In world _w_, we have ship _B_ at time _t_. Using my analysis of persistence within _w_, we determine that original ancestral stage with respect to _B_ at _t_; let us call that stage OAS(B). The following story holds in _w_. After the Ship came into existence at OAS(B), there was a gradual replacement of _B_'s parts so that ship _B_ at _t_ has _no_ parts in common with the ship found at stage OAS(B). Accordingly, let us call the original ship found at OAS(B), ship _A_. In _w_, then, ship _A_ came into existence, gradually had its parts replaced which resulted in ship _B_ at time _t_ in _w_. My analysis will include both stage (B,t) and OAS(B) (or we might now call it OAS(A)) in the same complete ancestry of stages since it will be possible to start with _B_ at _t_, and trace backwards a maximal continuous ancestry of stages _via_ local full diachronic linkage. This tracing takes us back to OAS(B).

The next facet of the analysis requires us to turn around and begin partitioning histories on the basis of global full diachronic linkage between OAS(B) and all

subsequent stages. Even though stage (B,t) is in the same complete ancestry as OAS(B), these two stages are stages of different ships. There will be a history partitioned off, from OAS(B) to some point during the replacement process, and from that point the partitioning will take up again until we reach stage (B,t). In terms of the bookkeeping tau-function, the k-value of the function will be greater than one, since there is more than one history in this complete ancestry of stages.

In another possible world w', suppose we have a ship C existing at time t'. The relevant question with respect to transworld identity would be: is ship B at t in w = ship C at t' in w'? This question will be answered in the affirmative if we operate simply on the hypothesis concerning identity of origins, and if we determine that the ships have the same origins (this does not refer to original ancestral stages). However, consider the following story about world w'. We use my analysis to check out ship C's status in w', and trace back and find the original stage OAS(C). However, the ship at OAS(C) in w' is in fact identical with the ship C existing at the later time t' in w'. In this world w', no parts of the original ship have been replaced at all.

Suppose that we have the following information. Ex hypothesi, stage OAS(B) in w is identical with OAS(C) in w'; they are the same beginnings, and therefore have the same original$_5$ properties associated with each original stage. Now, return to the question just raised: is ship B

at t in w = ship C at t' in w'? They have the same origins and so it would seem that they are the same ship. However, that doesn't seem correct. Although it is true that they have the same original stage, the two ships' histories diverged after their respective beginnings. What we also need to monitor is the extent to which objects undergo changes within their own world after their common origins.

How could this be accomplished? Not only do we demand that the two objects in different worlds have the same origin, but we also demand that the k-value associated with their respective tau-functions have the same value. This will determine whether or not the objects stand in the same relation to their original stages, which certainly seems to be a crucial feature given that we are analyzing the notion of identity across possible worlds.

Back to the original question: is ship B at t in w = ship C at t' in w'? No. Even though they have the same origins, they have differing k-values. The k-value of the tau-function for ship B at t in w is greater than one, as indicated earlier. On the other hand, the k-value of the tau-function for ship C at t' in w' is exactly one; that is, in the complete ancestry leading up to C at t', the same history is being followed, and there has been no need to partition off histories because there has been no change in the identity of the ship's significant proper parts. One interesting result of this solution arises out of the following question: is ship A in w (at OAS(B)) = ship C at t'

in w'? They both have the same origins, and they both have the same k-value (viz., one) for their respective tau-functions. Hence, these two ships are identical. But such a result is certainly not surprising; on the contrary, it seems to be exactly the result we demand in these cases.

The preceding discourse indicated that we need to consider features other than origins when determining if two objects are identical across possible worlds. The additional elements were found in the bookkeeping tau-function from my analysis. Even though we achieved this partial victory, there still remains the thorny difficulty about when origins of objects are identical across possible worlds. We are confronted with the dilemma of identifying original ancestral stages across worlds. In the following discussions I consider two possible ways around this problem. One advance involves an adaptation of D. Lewis' counterpart theory to this problem, while the other position is best summarized as a quasi-Brodyian interpretation of Kripke's stipulation analysis of possible worlds.

Prior to considering a Lewisian or Kripkean approach, there is an obstruction which must be clarified. Do we want to say that the original$_5$ properties of all of an object's proper parts are originally essential, or only restrict this claim of essentiality to the object's significant proper part's original$_5$ properties? Notice that regardless of which alternative we choose there will remain the same restrictions of how much change an object can undergo in

a world; that is, only the object's significant proper parts must retain their identity, while any other change is acceptable. I am ever so slightly inclined to believe that we should not restrict essential original$_5$ properties to significant proper parts, but rather should allow this to range over all of an object's proper parts.

Why choose this alternative? Because it will be difficult enough trying to identify original stages across worlds in which objects are composed out of proper parts with similar original$_5$ properties. If we only allow this to range over significant proper parts, then there will be wide variance from world to world with respect to identical object's insignificant proper parts at their origin. This variance would make the task of finding such original stages all the more difficult, or so it seems. Hence, we will side, ever so slightly, with the view in which all of an object's proper parts' original$_5$ properties are original essential properties of the proper parts.

It should be underscored that my support for this position is weak, and admittedly I have altered my stance on this question several times. It is a strict view which does have some harsh and odd consequences. For example, a very trivial change in an object's origin could have a tremendous impact in terms of that object's identity. Nonetheless, there are two sources of motivation which swing me towards this strict view: firstly, the problems with transworld identity articulated above carry some force.

Secondly, I find Kripke's assertion that an object originally could not fail to be made out of the matter that it was made out of full of intuitive appeal. To restrict that view to an object's significant proper parts would, in some sense, take the wind out of those sails. Of course, the other side can counter with their own intuitive argument that it makes more sense to allow for some variations in an object's origins. Isn't it possible that I could exist and have been created with only nine fingers? Indeed, this type of argument does have plausibility, but not enough to sway me in that direction.

Is it possible to adapt David Lewis' counterpart relation to our problem of trying to find a criterion for identifying original ancestral stages across worlds? The ensuing comments are meant to be suggestive of how this can be accomplished. What is Lewis' theory and what changes would it force in our project? Perhaps the greatest change would be that we are no longer talking about identity of objects across possible worlds. The counterpart relation is a relation of similarity, not identity. An object $\underline{\emptyset}$'s counterparts in other worlds are all and only those things which resemble $\underline{\emptyset}$ closely enough in important respects, and more closely than do other things in their worlds. The counterpart relation is context-bound and requires that we look at the "total story" of an object in a world. It is left up to us to determine what features of that total story within a world interests us the most. Lewis writes:

> The counterpart relation serves as a substitute for identity between things in different worlds. The principal advantage of the method of counterparts over the method of transworld identities is that if we adopted the latter in its most plausible form, we would say that things are identical with all and only those things which we would otherwise call their counterparts. But that could not be correct: first, because the counterpart relation is not transitive or symmetric, as identity is; and second, because the counterpart relation depends on the relative importances we attach to various different respects of similarity and dissimilarity, as identity does not.[6]

Lewis' framework would give the project of identifying original ancestral stages a new flavor. The problem now becomes two-fold: (i) since there are relative importances of different respects of similarity and dissimilarity, how should we weight these? What aspects should be consider to be more important with respect to similarity? (ii) Once we have set the parameters of the counterpart relation, how do we utilize this criteria for identifying objects across worlds (although this is a non-Lewisian way to put it)?

With respect to (i), what features of similarity do we place the highest premium on? The problem is that of trying to track down counterparts of original stages. Certainly an element of utmost priority is an object's original$_5$ properties. To get the most of this, we must stretch the interpretation of original$_5$ properties to its most extreme point. Certainly we will want to focus upon the original$_5$ properties of all of the object's proper parts, a decision consistent with our earlier one. This feature will help us

maximize the extent to which origins are similar, since it will extend to all proper parts. This suggestion builds our necessity of origins thesis into the counterpart relation. We consider an object $\underline{\emptyset}$ in world $\underline{w}$. With my analysis we determine that object's original ancestral stage, and give that stage a look to see what its original$_5$ properties are. We then go to another world $\underline{w}'$ to search for $\underline{\emptyset}$-in-$\underline{w}$'s counterpart. We select objects in $\underline{w}'$ and using my analysis within that world, we trace back and find that object's original ancestral stage. We then compare that stage's original$_5$ properties with those of $\underline{\emptyset}$-in-$\underline{w}$, trying to find that original ancestral stage in $\underline{w}'$ which is most similar with $\underline{\emptyset}$-in-$\underline{w}$.

This will not be a particularly easy task since it was admitted that original$_5$ properties, even when extended to all of an object's proper parts, are sometimes non-qualitative. That is why we need to extend the understanding of original$_5$ properties and couple it with my analysis in the following manner. Obviously, these moves are being pondered because we must worry about symmetrical worlds where objects share all qualitative properties.

Besides considering similarity of original$_5$ properties, we must also inspect the pasts and futures of the objects. This will give us additional information for assessing when an object is more similar to another object in a different world. We can easily assess an object's history after its origin on the basis of my analysis of persistence. This is

just the claim made earlier where we employ the bookkeeping tau-function to follow an object's history within a world. For the counterpart relation, we will follow an object's complete ancestry and see what happens to it in terms of my analysis. We will then compare such histories of objects, using such additional points of similarity to determine which objects are more similar to one another.

Besides the object's future, there is also the object's "past", that is, the time prior to the object coming into existence. One feature of original$_5$ properties will be helpful in this regard; namely, an object's external hereditary properties, understood in the broadest possible manner. In this case, we are interested in who created a particular object. The reader will realize that this is not without problems, since there will be difficulty in determining when an object's creator in one world is similar to the creator in another world. That is, we will have the same problem in trying to determine similarity of creators of objects, as we will with determining similarity of original stages. Nonetheless, to the extent that we can make sense out of this suggestion, this additional piece of information might be useful for our purposes. But does the creator of an artifact really matter to the object's identity? Perhaps the extent to which we are forcing the counterpart relation to play a relation it cannot play is showing strains.

It might appear as though something inappropriate is going on here. To what extent can we compare original5 properties between worlds and decide they are similar? As just argued, we might be able to do this for one type external hereditary property. However, we will not be able to accomplish this task with respect to an object's external hereditary (stuff) property, except in a roundabout fashion. In other words, we will not be able to decide when a certain class of micro-physical constituents are identical or similar to other constituents in another world except via the object's internal structural properties. We will have the ability to determine when different micro-structures in different worlds look alike, but we will not be able to go further and actually claim that the constituents of those micro-structures are one and the same (to slip out of counterpart talk just for a moment). I am presuming, then, that the micro-structure of a clay statue (i.e., the object's internal structural properties) in the actual world will closely resemble the micro-structure of that object in a world with different physical laws; that is, even if the laws give different causally necessary properties in the two worlds, the micro-structures will still be similar in kind. Consequently, we must rely upon internal structural properties to help us identify hunks of stuff as much as possible; but this will never quite reach the level of comparing actual stuff properties.

It is perhaps time to admit that the attempt to mold the counterpart relation to our needs and analysis is not going to obviously be successful. My analysis allows us to identify objects' original ancestral stages from world to world, but my analysis does no work when looking at the overall situation demanded by counterpart analysis. The major difficulty is that the counterpart relation is not transitive, and this feature of identity is basic to my analysis of persistence. One might try to identify an object with the class of all of its counterparts. But that is part of the problem, not part of the solution: an object can have more than one counterpart and the obstacle is trying to squeeze identity out of the counterpart relation. If $\underline{o}_1$ in $\underline{w}_1$ can be characterized by properties ABC, and $\underline{o}_2$ in $\underline{w}_2$ characterized by BCD, and $\underline{o}_3$ in $\underline{w}_3$ by properties CDE, we cannot identify $\underline{o}_1$ in $\underline{w}_1$ with $\underline{o}_3$ in $\underline{w}_3$, although we might want to. There exists the difficulty of obtaining inconsistent results when using the counterpart relation in the role of ersatz identity.

Although the foregoing has not produced the viable results hoped for, it is not clear that the counterpart relation totally fails to help us in solving the problem of transworld identity. Inasmuch as the counterpart relation involves a different perspective, somewhat far removed from the notion of identity we have been working with, it still seems possible that with sufficient recalibrations of my

analysis, progress might be obtained. That project, however, is beyond my scope and vision.

Now that we have seen the Lewisian possible solution to our problem, what is the modified Kripkean alternative response? To some extent my comments will be incomplete since it is unclear what Kripke has in mind by his urgings. As previously mentioned, Kripke believes that the problem of transworld identity grows out of a distorted picture of what possible worlds are. We must remember, he cautions us, that possible worlds are not discovered by looking through a telescope, but rather they are just certain counter-factual situations which we stipulate. Kripke goes cryptic thereafter:

> Don't ask: how can I identify this table in another possible world, except by its properties? I have the table in my hands, I can point to it, and when I ask whether it might have been in another room, I am talking by definition, about it. I don't have to identify it after seeking it through a telescope. If I am talking about it, I am talking about it, in the same way as when I say that our hands might have been painted green, I have stipulated that I am talking about greenness...So, we do not begin with worlds..., and then ask about criteria of transworld identification; on the contrary, we begin with the objects, which we have, and can identify, in the actual world. We can then ask whether certain things might have been true of the objects.[7]

In the ensuing discussions, it might be the case that I diverge from what Kripke intends by these comments. But since few can discern what he might actually mean by them

vis-a-vis a solution to the problem of transworld identity, no one is the worse for it.

The basic idea is to take Kripke's comments and couple them with a Brody-type view. That is, in identifying objects across possible worlds, we will only be concerned with worlds which branch after an object's time of origin in the actual world. In other words, as Kripke says, we have an object in this world, and transworld identity just amounts to asking what could happen to that object in different alternative futures. This seemingly avoids the problem of having to "go into" another possible world to track down an identical original ancestral stage. Kripke would claim that the question, "when are two original ancestral stages in different possible worlds identical?", is settled by stipulation. We start with an object, with its original ancestral stage in this world, and then consider various counterfactual situations involving this object.

The trouble which plagued Brody's account of essentialism <u>via</u> this route revolved around all sorts of bizarre properties being essential. But it appears that this might not be a problem for the current plan. Afterall, we have already pinpointed what properties we think are essential at the time of an object's origin; we thereby get around the problem that plagued Brody concerning original essential properties.

The present suggestion says that there is no real problem with transworld identity. We have an object in this world, we know what original properties are essential to it. That object exists in other possible worlds which branch after the object comes into existence. If we want to know if an object in such a counterfactually stipulated possible world is identical with the original object, we presumably just apply my analysis of persistence in the following manner. Given the object's origin in this world, to which we have direct access, we know what changes the object can undergo while retaining its identity; this is known on the basis of applying my analysis. We then stipulate some possible world where, for example, all the parts of the object have been gradually replaced, and then ask if that object is identical with the object which came into existence in the actual world. The answer would be negative since an object cannot have all of its parts replaced.

A better understanding of how stipulation might help us can be gained by coupling this view with some of Quine.[8] We might want to assume that a possible world is simply a distribution of elementary particles of the actual world over space-time regions. This enables one to identify micro-physical constituents across worlds because the basic constituents given in the actual world completely determine what these other worlds will "be made out of." That is to say, a possible world will be identified with some possible

distribution of our actual elementary particles over space-time. This, then, is the beginning of a solution to the problem of transworld identity by stipulation: a possible world just is a distribution of our basic constituents.

There might be some problems to such a view. For example, it will be necessary that the world contains the basic constituents that it does contain. Moreover, it might be the case that this perspective requires certain physical laws to be invariant. However, neither of these difficulties seems to be particularly disturbing.

There are obvious advantages to such stipulation. It will be recalled that my analysis of persistence fared quite well within a world, but broke down when it was asked to identify micro-physical constituents across possible worlds. If one stipulates that there exist only the basic constituents of the actual world, then this problem of "going into" another world and searching for a variety of "unfamiliar" basic constituents falls away. It might be objected that this move represents nothing more than sleight of hand, or deciding to solve a problem by pretending it doesn't exist. But Kripke's stipulation analysis, when unfolded in this manner, does have strong appeal. Not just because it seems to work and we desperately want a solution, but because this view of what a possible world is seems more plausible than other interpretations which have been offered. The Lewis realist position requires one to countenance a variety of views that are not entirely palatable.

The perspective endorsed here, utilizing Kripke, Brody, Quine, and my analysis, requires nothing more than our starting with the world we have access to, and pondering various alternative histories of this world. My analysis of persistence works within this framework and provides some of the answers we have been searching for.

There are no clear conclusions to these investigations. The counterpart adaptation did not seem particularly fruitful. The expanded stipulation analysis produced more hopeful results, and certainly seem to be pointing in the right direction. With further moves, the stipulation analysis and my analysis of persistence should produce a suitable resolution to the problem of transworld identity.

CHAPTER VIII

RELATIVE AND ABSOLUTE IDENTITY

The concept of identity plays a central role in my analysis of the persistence of physical objects. Recently, there have been vigorous debates among philosophers about the theory of identity. The "classical" theory of absolute identity has been challenged by the theory of relative identity. In this Chapter, I present both positions, arguing that my analysis is neutral on the issue of which theory ought to be adopted. Fortunately, both positions can be separately fitted into my analysis, although there are certain restrictions placed on these theories by my analysis. Generally, this Chapter presents a discussion of these views on identity and indicates how both theories can accommodate my analysis of persistence.

(i) The theory of absolute identity (hereafter "AI") is termed "classical" because it is the theory found in almost all logic textbooks. Although there are a variety of ways to express AI, it can generally be understood to assert the following "indiscernibility of identicals": $(\forall x)(\forall y)[x=y \rightarrow (\forall \phi)(\phi x \equiv \phi y)]$. AI exhibits reflexivity, symmetry, and transitivity. Within the context of our discussion, namely the problem of an object's identity through time, the theory of AI can be understood as follows. For any object-stage, the object of that stage is not antecedant

to the sortal which defines it. Rather, the sortal uniquely determines the object being specified. If we "pick" a sortal for a particular object-stage, the object "comes along with that sortal." Accordingly, the absolutist believes that the sortal is the "rule" by which we carve out reality in these situations. Consequently, the absolutist can ask of two stages, stage s at t and stage s' at t', does s at t = s' at t'? The absolutist does not believe that this is ambiguous or an incomplete statement, as we will see the relativist does. The absolutist charges that it makes sense to claim that "s at t is the same thing as s' at t'."

It might appear that the absolutist will have certain problems with ostension. Suppose we have a statue made out of gold. If an absolutist points at that entity and claims that it is the same thing as the entity that sat in that spot yesterday, is he talking about the statue or about the piece of gold? It is not clear that the absolutist does have a problem here. The names that the absolutist uses in such a situation will invoke a particular sortal; such individual reference presupposes some uniquely determining sortal. The absolutist, then, maintains that the identity relation must be understood as the classical two-place identity operator. Questions about the objects being identical with respect to sortals, and so forth, are misplaced and unnecessary.

The theory of relative identity (hereafter "RI") seeks to replace the theory of AI with a three-place identity relation, the third place being filled by a covering concept or sortal which specifies the respect in which the two individuals are identical. The relativist argues that the question raised by the absolutist, namely "is s at t the same thing as s' at t'?", is an incomplete question; we need to ask, "is s at t the same sort of thing (e.g., 'statue') as s' at t'?"

Through the various writings of Geach,[1] Wiggins,[2] and Griffin,[3] a number of relativist theses have been advanced. However, it appears that the two following claims, although not endorsed by all of these writers, gives an appropriate insight into the flavor of RI.

(R1) Absolute identity statements require completion to give a statement of the form '$\underline{a}$ is the same $\underline{A}$ as $\underline{b}$', i.e., '$\underline{a}=_{A}\underline{b}$'.

(R2) $\underline{a}$ may be the same $\underline{A}$ as $\underline{b}$ and not the same $\underline{B}$, i.e., $\Diamond [(a=_{A}b) \ \& \ \sim(a=_{B}b)]$.

For the relativist, persistence of an object depends upon the choice of a sortal. The relativist, *contra* the absolutist, believes that the object is antecedant to any sortal which defines it. We are given a "bare" object, so to speak, and can choose different sortals to apply to that object. Relative to our sortal choice, we will have varying identity claims.

One interesting question for these two theories asks: is an object identical to the material from which it is made?

Specifically, is statue s identical to the piece of gold g from which it is constituted? For the absolutist, there are two non-equivalent ways of answering this question. (ai) s=g, where s is just a "temporal component" of g; that is 'statue' is just a phase sortal in the history of g. (aii) s ≠ g, where s is a "temporal segment" of g (or s is stage-identical with g), but s and g are distinct objects, unlike position (ai). For the relativist, there are two questions relevant to this controversy. (ri) Is s the same statue as g? and (rii) is s the same piece of gold as g? Which of these options to choose may depend upon many different points. However, when these questions are examined in the perspective of my analysis of persistence, it will be seen that certain choices are forced and others cut off.

A central tenet of this Chapter is that my analysis of persistence is neutral with respect to the absolute versus relative identity controversy. It is possible to adopt either position and then use my analysis to decide questions about the persistence of objects. This neutrality is a great benefit for my analysis. This feature will be demonstrated in the following discussions where I fit each theory into the analysis to see just how it operates.

Let us consider what happens when absolute identity is coupled with my analysis of persistence. My analysis delivers an answer to the question posed for the absolutist about the relationship of an object to the material from which it is made. Interpretation (ai) is ruled out by my

analysis, since 'statue' is not a phase sortal but a maximal sortal on my account. The picture given by my analysis is not that the statue is a "temporal component" of the piece of gold, as (ai) specifies, but that the statue is a "temporal segment" of the piece of gold although they are not identical, as indicated by position (aii).

In saying that an object is not (absolutely) identical to the material from which it is made, the question arises as to the relationship between these two entities. On my analysis, coupled with AI, we will get a view which might be called "stage-parallelism", characterized by "stage-identity." The former notion is just that for any object-stage, there (can) exist stages which run "parallel" to each other. Consider a gold statue existing at time t. On my account, we will trace out a complete ancestry of the statue at t, locating the original ancestral stage with respect to the statue at t, thereafter partitioning histories of the statue. The sortal 'statue', on the AI view, uniquely determines a particular object at a time, and with my analysis, we will be able to ask of any two stages a and b in this complete ancestry, does a = b? However, we will also be able to trace out a complete ancestry for the object 'piece of gold' which also exists at t, finding its original ancestral stage and partitioning off its histories. While the statue exists, it might be said that there is a stage-parallelism between the statue-ancestry and the piece of

gold-ancestry. But can anything further be said about the relationship of these objects?

Borrowing a notion from J. Perry,[4] we will say that the statue and piece of gold are stage-identical at a certain time.

(SI) Two objects X and Y are stage-identical at t (i.e., SI(X,Y,t)) if and only if X and Y occupy the same space-time region at t.

Stage-identity is not a type of identity. Rather, objects X and Y have the same substance or proper parts at a particular time t, which is not to directly say that X is numerically the same entity as Y. On the other hand, the relation of stage-identity does not exclude the possibility of X and Y being identical, although we have ruled out that possibility as expressed earlier in (ai) because of features of my analysis.

The relation of stage-identity is closely linked with the relation of being "constituted by", which has received attention of late. When we say that "the statue is gold" we are not using the "is" of identity, but rather the "is" of constitution. So, this sentence really asserts that "the statue is constituted out of the gold." Within the present perspective, it could be said that the constitutive "is" is the "is" of stage-identity, although it is not the "is" of absolute identity. However, even granting this assertion, not a great deal is understood about the relationship of "construction." Part of the remaining project is to shed some light upon this relationship.

Reflection upon stage-identity and constitution in conjunction with my analysis reveals a curious asymmetric dependence. Consider the statue made out of the piece of gold. Although it is possible to imagine the piece of gold existing without it being stage-identical with the statue, it is not possible to imagine the statue existing without being stage-identical with that piece of gold. This follows as a result from my analysis. Although the statue might be melted down, the same piece of gold continues to persist throughout it all. However, if we no longer have the same piece of gold, we certainly will no longer have the same statue on my analysis.

This relationship might be termed the "necessary asymmetric dependence of stage-identity and constitution." Symbolically, the dependence can be characterized as follows:

(a) $\Box(\forall t)$ {SI(statue, gold, t) & [$\exists t', t'>t$) (statue exists at t') $\rightarrow$ SI(s,g,t')}

(b) $\sim\Box(\forall t)${SI(statue, gold, t) & ($\exists t', t'>t$) (piece of gold exists at t') $\rightarrow$ SI(s,g,t')}

The theory of AI, when coupled with my analysis, produced a stage-parallelism in which the constituted object and the material which constitutes it are stage-identical. The constituted object stands in a dependent relationship to its material constituents, a relationship which the constituents fail to stand in with the constituted object. That much is a direct result of my analysis and the

importance it places upon the continuity of an object's proper parts in order for persistence to be perpetuated.

What results when RI is coupled with my analysis of persistence? The relativist thesis (R2) undergoes some modifications when confronted with my analysis. (R2) asserted that: $\Diamond [(a=_A b) \ \& \ \sim(a=_B b)]$. However, there are some restrictions on what sortals may occupy "A" and "B". For example, my analysis allows that A='piece of gold' and B='statue'. In other words, it is possible that objects A and B are the same piece of gold but not the same statue. Such a relationship would hold between a gold statue ('a') and the piece of gold from the melted down statue ('b'). In that case, both a and b would be the same piece of gold, since the melting process does not disrupt the identity of the piece, but a and b would not be the same statue, since b is not a statue at all.

Can we switch the sortals around so that we obtain the following state of affairs: $\Diamond [(a=b)_{\text{statue}} \ \& \ \sim (a=b)_{\text{piece of gold}}]$? No, this result is not possible. This appears to be the same asymmetric relationship discussed under AI between a constituted object and the material from which it is made. That we should find similar results is not surprising, however, since it is a consequence of my analysis that there be this necessary asymmetric dependence. For RI, we can express this relationship accordingly:

(a') $\Box$ [(a=b) $\rightarrow$ (a=b)];
statue piece of gold

(b') $\sim\Box$[(a=b) $\rightarrow$ (a=b)].
piece of gold statue

The restriction my analysis forces upon the relativist's thesis (R2) rules out N. Griffin's "resolution" of the Ship of Theseus controversy.[5] Griffin claims that a (R2) relativist can offer the following solution, where 'X' is the original ship, 'Y' is the ship with replaced parts and spatio-temporally continuous with 'X', and 'Z' is the ship reassembled out of 'X's' original parts:

(i) X is the same collection of planks as Z; and
(ii) X is not the same ship as Z.

This, of course, is an example of the thesis (R2), but it is an interpretation of (R2) disallowed by my analysis. Likewise, Griffin's constructive solution to the controversy, while an example of (R2), also runs counter to my analysis:

(iii) X is the same ship as Y; and
(iv) X is not the same collection of planks as Y.

Although Griffin's relativist solution to the Theseus controversy does not run through, a relativist would have no trouble expressing the proper results for the Theseus case offered by my analysis. The relativist can assert:

(v) X is the same collection of planks as Z; and
(vi) X is not the same collection of planks as Y; and
(vii) X is the same ship as Z; and
(viii) X is not the same ship as Y.

The (R2) relativist is left without any assertions in this case, but a (R1) relativist solution is offered which is consistent with my analysis of persistence.

There is a similarity, then, between the results one obtains when coupling both AI and RI with my analysis. What we have found is that certain interpretations of these theories are ruled out since they conflict with the findings of my analysis. The similarity that emerges is that the constituted objects are necessarily dependent upon their constituents, although the converse does not follow in the same manner.

One difference between the adoption of AI versus RI is that the latter does not produce a "stage-parallelism" in the manner that AI did. We concluded that the "is" of constitution is independent of the "is" of absolute identity, although the former coincides with the "is" of stage-identity. For RI, there are not parallel stages at a given time as with AI, but just a single stage of objects of which it is a stage, and we get various answers about its identity relation depending on the sortal we choose for that stage. Ultimately, however, the central question is: on the RI format, will we get different persistence criteria for objects, or just a different perspective in which the same persistence criteria are invoked? I believe only the latter. While the absolutist neatly traces out parallel ancestries, one for 'statue' and one for 'piece of gold', the relativist

will ask if a certain individual stage at a time is either the same 'statue' as another stage at another time, or the same 'piece of gold', and he may get varying answers for both questions. But, in the end, when it comes to actually determining persistence at different times, I do not believe that the adoption of AI or RI will alter how we partition the relevant histories. Although the manner in which the analysis is carried out might vary, one still tracks down the original ancestral stage and partitions histories on that basis.

A further question, nonetheless, concerns whether the "is" of constitution is independent from the "is" of relative identity. To answer this, we might embrace another perspective for RI. Up to this juncture, we have been only considering relative identity statements in which the objects exist at different times. Accordingly, the results of my analysis of identity through time centrally affect those determinations. But what about relative identity statements for entities existing at the same times? Consider the gold statue, denoting the statue by 's' and the piece of gold by 'g'. The interesting case is not the obviously false claim that: s=g, but the claim that s=g. Is
statue piece of gold
this claim of constitution a relative identity statement? We have already noted the asymmetric dependence between s and g; this holds for both AI and RI. As far as I can determine, nothing crucial ultimately depends upon the answer

to this query. However, my inclinations are to go with the results endorsed in the AI scheme, where the "is" of constitution is different than the "is" of either absolute or relative identity. But, it should be noted that the question, "is s the same piece of gold as g?" is an intelligible question. We can answer the question affirmatively, and we do, not because it expresses a relative identity, but rather because it covertly expresses the relationship of stage-identity which we found earlier to be a natural notion. That is, when we affirm that s is the same piece of gold as g, we are pointing to the fact that both s and g occupy the same space-time region at that particular time. We are not asserting, however, that relative to the sortal 'piece of gold', s = g. As I said above, nothing ultimately depends upon this position; however, since it does ascribe an important role to constitution and is consonant with the asymmetric dependence noted earlier, it seems like a better alternative to adopt.

There remains one further obstacle to the union of RI with my analysis of persistence. For RI, it is not meaningful to ask about identities without reference to a particular sortal. What is bothersome is that, on my analysis, we must ask about significant proper parts. But for the relativist, the question becomes, "significant relative to which sortals?" That is, which sortal is the correct sortal to choose for monitoring the significant proper part in question? This is a problem because of the recursive nature of my analysis.

For example, given the sortal 'watch', my analysis checks the identity of its significant proper parts, namely the 'watchhead', and its identity depends upon the continued identity of the head's significant proper parts, such as the 'main spring' and whatever. The relativist must be concerned about the preservation of these identities, but with respect to which sortals?

This difficulty, while most pressing for the relativist, could also be somewhat obtrusive for the absolutist, but not in the same manner. The absolutist must also be concerned about the identity of significant proper parts from stage to stage, and the problem arises there about which sortals are needed to pick out those parts. However, the absolutist believes that this is determined uniquely by the sortal which defines the object in consideration. Unlike the relativist, the absolutist would not have the same "indeterminacy" about what proper parts are significant given the sortal in question. Nonetheless, there is still the appropriate (timeless) question to ask of the absolutist as to whether or not the sortal uniquely determines the significant proper parts of an object? This, in effect, is the question now posed by the relativist.

If the sortal for an object determines the sortal for the significant proper parts, then the relativist will have no problem using my analysis of persistence. As we have witnessed, the identity of an object, on my analysis, depends upon that object's significant proper parts remaining

under their relevant sortals. In this sense, then, the identity of the object, or the ability of that object to fall under the appropriate sortal, is parasitic upon the ability of its proper parts to remain under their relevant sortals. This could be paraphrased as such: "if one destroyed the G-ness of the (significant) proper part, one would destroy the F-ness of the whole" (e.g., "if one destroyed the watchhead-ness of the watchhead, one would destroy the watch-ness of the whole watch.").

This problem can be rectified by the following stipulation:

> α is a significant proper part of β if and only if $(\exists \emptyset)$, where $\emptyset$ is a [set of] properties such that:
> (i) α uniquely instantiates $\emptyset$, and
> (ii) $\Box (\forall x)\{S_{\beta}(x) \rightarrow (\exists y)(y \text{ is part of } x \ \& \ \emptyset(y))\}$.

This characterization specifies that there exists a set of properties (or a description) which the part uniquely satisfies, and which are such that necessarily any object which is 'F' has a part which satisfies this unique description. If that part ceased to fall under the relevant sortal, then the object would cease to be an 'F'. To avoid circularity we utilize de dicto necessity. The above characterization circumvents the problem which arises for the relativist. Once the relativist has picked a sortal for the object, he has determined which sortals are relevant for choosing significant proper parts. Then, as usual, these proper parts' persistence is monitored.

The conclusion of the foregoing investigation is that my analysis can be used successfully either by the absolutist or by the relativist. Certain restrictions are forced upon both theories by my analysis; however, given the acceptance of the results of my analysis, we can say that these restrictions are necessary and proper.

FOOTNOTES

Chapter II

[1]T. Hobbes, Concerning Body, Chapter XI, sec. 7.

[2]Louis Loeb brought this counterexample to my attention.

Chapter III

[1]E. Hirsch, The Persistence of Objects, (Philosophical Monographs, Philadelphia, 1976).

[2]D. Wiggins, Identity and Spatio-Temporal Continuity, (Basil Blackwell, Oxford, 1967).

[3]Hirsch, Ibid., p. 15.

[4]Hirsch, Ibid., p. 21.

[5]Wiggins, Ibid., p. 35.

[6]Hirsch, Ibid., p. 15.

[7]Hirsch, Ibid., p. 3.

[8]Hirsch, Ibid., p. 6.

[9]Hirsch, Ibid., p. 26.

[10]Hirsch, Ibid., p. 32.

Chapter IV

[1]L. Sklar, Space, Time, and Space-Time, (University of California Press, Los Angeles, 1975).

[2]D. Lewis, Counterfactuals, (Harvard University Press, Cambridge, 1973), p. 1.

[3]A potential problem for this recursive treatment concerns whether or not a maximal sortal determines what counts as significant proper parts. This problem is considered in Chapter VIII.

[4]Of course, full diachronic linkage is also a recursive notion which must obtain at descending levels of analysis. Throughout the remaining discussions, then, this recursiveness is constantly at work, although at many junctures I do not overtly speak about the levels of recursive full diachronic linkage.

Chapter V

[1]Kripke, Saul, 'Naming and Necessity', in D. Davidson and G. Harman (eds.), Semantics of Natural Language, (D. Reidel Publishing Co., Dordrecht, 1972).

[2]Gibbard, Allan, 'Contingent Identity', Journal of Philosophical Logic 4 (1975) 187-221.

[3]I realize that the attempt to segregate relational and nonrelational properties might be problematic. So, I use the distinction suggestively, understanding relational properties to be facts about an object related to other (constituted) objects, whereas nonrelational properties contain no such reference.

[4]I realize that it remains awkward to claim that a free basic constituent qua stuff has a basic constituent as a spatio-temporal part, i.e., that it has itself as a spatio-temporal part. I am convinced that this awkwardness is not disruptive. Since the existence of the free basic constituent is of minor importance in this total project, I will no longer discuss it. Whenever I discuss "stuff with basic constituents" I intend such talk to discount free basic constituents, although with modifications their role could be included.

[5]Kripke, Ibid., pp. 320-321.

Chapter VI

[1]S. Kripke, 'Naming and Necessity', pp. 313-314.

Chapter VII

[1]Much of the following discussion comes from lectures given at the University of Michigan by Professor Tim McCarthy; any mistakes are mine.

[2]Alvin Plantinga, The Nature of Necessity, (Oxford: Clarendon Press, 1974).

[3]S. Kripke, 'Naming and Necessity', pp. 266-267.

[4]Baruch Brody, 'Why Settle for Anything Less than Good Old-Fashioned Aristotlean Essentialism', Nous 7 (1973), pp. 351-364.

[5]A. Gibbard, 'Contingent Identity', p. 196.

[6]David K. Lewis, "Counterparts of Persons and Their Bodies", Journal of Philosophy 68 (1971), p. 206.

[7]Kripke, Ibid., p. 273.

[8]W.V.O. Quine, 'Worlds Away', Journal of Philosophy 73 (1976), pp. 859-863.

Chapter VIII

[1]P. T. Geach, Logic Matters (Oxford: Blackwell, 1972).

[2]David Wiggins, Identity and Spatio-Temporal Continuity (Oxford: Blackwell, 1967).

[3]Nicholas Griffin, Relative Identity (Oxford: Clarendon Press, 1977).

[4]John Perry, 'The Same F', Philosophical Review 79 (1970), pp. 181-200.

[5]Griffin, Ibid., pp. 177-179.

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