

Thoughts, Things, and Theories

Abstract:

We to critique the following question: can we have reasonable certainty that the terms in speculative or empirical theories correspond meaningfully to things in the ontological structure of the world, or are they only convenient fictions useful for predicting phenomena? We first justify this question as meaningful, and capable of admitting a meaningful answer. We then analyze question itself with examples from physics and biology. We conclude that we can be reasonably certain that the terms in an empirical theory have some degree of ontological significance, provided that they are directly related to phenomenal experiences. We also suggest that the advance of science can be aided through this understanding. Finally we use these conclusions to analyze the existence of the mind and certain physical structures.

I. Ontological Preliminary

Our overall goal is to determine whether or not the terms in speculative theory, whether of metaphysics or empirical science, can be thought, with at least some degree of justification, to have ontological significance or accuracy. The alternative would be to say that terms in an empirical theory are merely computational conveniences. For example, in a given theory of the solar system, planets are represented as having positions which are vectors in a three-dimensional space (Cassiday et al., 1999). Certainly, by using these vectors, we are able to obtain good predictions of where we will see the planets when we look for them, but does it follow that these position vectors correspond in any way to some real part of the world, or is it merely a convenient mathematical fiction?

Before we can address this question directly we must first ask what it would *mean* for the terms in a theory to have ontological significance. After all some philosophers have, for one reason or another, rejected the question which we have posed as being meaningless or at least as having no meaningful answer (Hume, 1999; Kant, 1990). To this end we will commence with a brief discussion of ontology and epistemology. The position which we will present has its roots in (James, 1977a; Whitehead, 1978), although our position may have some distinctions from theirs.

Let us begin by discussing our perceptions or more precisely our thoughts (for we will consider

perception to be a kind of thought). It is not a priori clear that, in a given event of thought, there are any parts of that thought which exist independently of that event (Nietzsche, 1968). In other words, it is certain that there is a thought of some kind, but not that there is a thinker or a 'thing thought of' which exist independently of the event of the thought.

However, in a given thought, there are always different parts or aspects of the thought which can be distinguished from the total event. First, there is the content. When a person sees a field of colour, say green for concreteness, that 'green' is distinguishable, at least as a distinct part of the event of thought. In particular, it is seen that this 'green' is similar to the content of some other event of thought, perhaps at a different place or time in the person's visual field, or perhaps for a different mind entirely. When a person thinks of a concept, an abstract notion, the concept itself is distinguished from the thought in which it plays a role, at least insofar as that same awareness could be instead aware of something else, or some other awareness could instead be thinking that concept, or the same awareness at a different time or a different way, and so on. Therefore likewise the consciousness whose event this is, is distinguished from the event of the thought, at least as a distinct part of the event. The 'person seeing green' is the same consciousness that also sees red, hears a song, and at other times has other experiences, or at least a consciousness related to those others in a very specific way, just as the various 'green contents' are related to one another. Thus Russell's statement that 'the patch of colour and our sensation in seeing it are identical' cannot be quite right (2005, 84). Certainly the patch of colour itself is a part of the event of the sensation, and it may be that the patch of colour can only exist as part of a sensation, but still it is a *distinguishable* component of that sensation, as is the consciousness involved. On the other hand if it *does* exist independently, then it is still itself the thing that is part of the sensation; thoughts appropriate or include their content as part of the event of the thought, not merely some model of the content.

So we can distinguish the content and the consciousness involved in the thought as distinct aspects

of the thought. But although the content and the consciousness are distinguishable parts of the event of the thought, this does not mean they exist independently of it. If we consider a red square, neither the colour nor the shape could be there without the other, or at least without something *like* the other. A shape has to have some colour, and a colour has to have some shape, even though we can distinguish the colour and shape as separate components in the red square itself (admittedly, when one takes shading into account, one finds that one must be a little more careful in how one interprets this, but the basic principle remains the same). Likewise, it is possible that a consciousness has to be in an event of thought and a content has to be in an event of thought. On the other hand, a line segment can be the side of a square, but it does not need to be so in order to exist. One could analogously say that in a thought, the consciousness or the content are parts of the event, but one or both of them also exist independently of it (or at least one could say this of some types of contents of thoughts). In fact the truth is that probably some thoughts have content which cannot exist outside of thoughts, and other thoughts have contents which can do so. We do not mean that these thoughts are merely descriptive of such things, but that those things are themselves the contents of the thoughts; a thought which is descriptive of something has its content some conceptual description which is posited as descriptive of some other part of the world, and not that other part of the world itself, whereas a perception involves some part of the world forming the actual content of the thought. However, there would be no inherent contradiction in holding that all the things which are the contents of thoughts exist independently of the thoughts. Also, many thoughts must involve multiple contents: perhaps a descriptive concept together with a particular sensation, which are being compared to see whether the concept and sensation match.

As a momentary aside, this position does contradict some interpretations of the content and consciousness as Aristotelian ‘substances,’ because such substances are supposed to be described entirely by predicates and not in terms of one another, and we have here said that part of the description of the consciousness is that it is ‘perceiving this content,’ and part of the description of the content is

that it is ‘being perceived by...’ (Aristotle, 2001; Whitehead, 1978). Of course the rest of the facts about the content are in general going to be independent of the fact that it is the content of some perception, unless the content is actually dependent on being perceived for its existence. Whether or not this interpretation of Aristotle is correct is beyond the subject of our current exposition, but it suffices to note that this treatment of objects being described by one another while still having some existence (or properties) independently of one another is fully consistent with the use of relations in language and logic.

Returning to our discussion of the nature of thoughts, we can now say that every thought is a thought *of some thing or things, by some subject*. In some cases it might be that the thing which is perceived does not exist independently of the event of the thought, but in other cases it might exist independently of being perceived, or a mix of the two. But if the content exists independently of the thought, it is still the case that the thing that is perceived (the content of the thought) is the very thing that exists independently of the thought, as we have said before; that independently existing thing is appropriated or included in the thought, even though it does not need to be included as the content of a thought in order to exist (just as a line segment need not be included as part of a square to exist). In this way we realize the idea of James to have the whole world built out of the same stuff that constitutes the components of experiences (1977a). Therefore, anything that exists in any sense, even an event of thought, could, in theory at least, be the content of a thought (or even the content of multiple thoughts by multiple minds). Of course this does not mean that a human mind would necessarily be able to perceive it; our thoughts come to us in a very limited set of forms. However if there is something that we cannot perceive, it is not the case that we fundamentally cannot do so, but rather that we simply do not have the means to ‘position ourselves’ to do so. It is more like saying that our eyes are too weak; some other sort of individual could have stronger eyes than ours and be able to see the thing we cannot.

It is interesting from an epistemological standpoint to ask whether or not a mind could have

certainty that the content of some thought existed independently of the thought itself. At least in theory this is certainly possible. When a person sees green, as in our previous example, there are some properties of the event that are absolutely certain: it is, for example, *their* sight, it is a *sight* as opposed to some other kind of thought, and it is *of green* in some fashion. Now in principle, there is no reason why some mind could not have an event of thought given in such a fashion that it would be absolutely certain that it was ‘of something existing independently of the thought.’ But whether or not humans ever achieve thoughts with such certainty about the being of the content we will not try to answer here. In fact for the purposes of our exposition it is not even necessary to affirm that in some cases of thought, the content of the thought exists independently of being perceived, or that anything can exist except as the content of a thought. But, if we appeal to our intuition, it certainly seems possible to at least understand this conceptually, if not to find evidence of it in experience. For a discussion on this matter see (Winter, 2008).

Now it is even possible, at least in theory, that activity and power, both causal and otherwise, could be perceived (that is, itself be the content of thought); a number of philosophers have even maintained that we do directly experience such activity (James, 1977b; Pink, 2004; Whitehead, 1978). For our purposes it is not necessary to suppose that we experience such things, as long as we can conceptualize them (i.e. have thoughts whose content is an abstract description of them), and realize that at least in theory they are perceivable. For we will then ask whether the causal properties of things behave in patterns which are described by our theories; this is especially convenient when our theory involves a number of mathematical relations, for we can then ask whether those relations correspond to the causal relations among these governing principles.

We can now return to the original question and define what we mean when we ask whether the terms in a given empirical theory have any ontological significance. We mean to ask whether or not the terms in a theory match up with objects that exist in reality; not merely objects which exist in some

kind of indescribable, unknowable way (that is, a sort of Kantian noumena), but rather eminently comprehensible, potentially perceivable things, although such things need not be in fact perceived by us or by anyone. We wish to know whether, for example, rays of light are merely things that can produce colours in our minds with no further accessible properties, or if they are also things which can be described (or approximated) in themselves by the mathematical equations of electromagnetic theory. Our above discussion shows that such a query is both meaningful and comprehensible, and can potentially be given a meaningful answer, for we can know, at least in part, what it would mean to say that they are described by such equations as well as being the things responsible for the colours we see. Of course any theory must relate in some way to the things that we perceive if we are to be able to test them empirically. But in addition most theories will refer to things that we do not directly perceive either. In fact in many theories the majority of the theory is concerned with constructs which we do not directly perceive. As another example, in the theory of the solar system mentioned before, the solar system is described as a collection of point particles interacting through gravity. What we perceive on the other hand is just a collection of colours when we look into telescopes. The theory connects to these perceptions by relating the collection of points to the angles that such measurements should be made at. We wish to know if the solar system is merely an unknown something responsible for those colours, or whether it can in itself be described approximately as a collection of point particles interacting gravitationally.

II. The Existence of Unperceived Elements

Before we can consider whether or not the terms in any given theory correspond to any aspect of reality, we must ask why it is the case that we should think there are any things other than those which we perceive. Russell, for example, suggested in his later philosophy that an object such a table should be taken to be merely the collection of perceptions which we would ordinarily associate together as a

single table (2005). On the other hand, we are uncomfortable with the idea that this is all that there is. Not because we think that there must be more to the table than these appearances per se, but because these appearances have such a distinctive and organized pattern. To take a different example, Nietzsche observed that there is no need to separate the flash from the lightning, as though the lightning was anything over and above the flashes seen by various individuals, and claims that in general anything that is interpreted as an effect should really be considered as simply inherent in the total event (1968). But this misses the point. It is true that there is no need to suppose there is any control over the sense data corresponding to the table, or anything to the event of the lightning other than the flash, but it seems unlikely that there is nothing more when we consider that events of lightning are generally followed by thunder, and that the table does not suddenly appear or disappear. But the fact that there are such patterns of regularity suggests to us that there is some sort of additional control over our perceptions.

Russell of course admits this, and maintains that there are 'laws' which govern these perceptions. But two points must be made. First such laws are not perceived by us along with the perceptions, although if they exist then we maintain they are in principle the sorts of things which can be both conceived and directly perceived. But second, they cannot have as their additional initial data merely those perceptions we have of the table or the lightning. After all we can produce similar perceptions in imagination, or create the image of a table in a photograph, or a flash of light without producing thunder afterwards. It follows that whatever these laws are that Russell refers to, they must involve some additional data other than the sense data which is available to us, if they are to carry out the very purpose for which Russell admits them (in fairness to Russell, it is possible that he intended for such additional data to be taken as part of the world, since he wishes to define the table as all things that would be taken to be the table under all 'different points of view;' 2005, 57). Therefore, there must be some ontologically existent 'principles' (in the phraseology of Sartre) which are not merely general

laws over perceptions but also specific data for those laws (1956, 5).

Therefore, we have shown that it is reasonable to think that there are things including both universal laws and specific data for those laws which are not perceived by us, which are involved in the production or control of the experiences which we have, although we cannot perhaps have complete certainty of this fact without additional perceptions. We will call all such things ‘principles.’ Our next task is to determine to what degree we can be reasonably certain that we can describe these things.

III. Speculation About the Nature of Such Principles

The problem before us is that, while we can be reasonably certain that there are principles governing our perceptions, unless we find a method whereby we can directly perceive these controlling principles, it will be difficult to check whether or not a given description of them is accurate or not. This must be distinguished from whether or not it is possible to check and see whether a given speculation is useful for predicting the experiences that we will have. A theory may after all be useful for this without having any ontological significance whatsoever, and arguably we might say that there is no reason to worry about whether or not a given theory has such significance. We will deal with the question of whether or not there is any reason to want our theory to have such significance later, although for the moment we will say that merely from the perspective of our intrinsic curiosity, we would like to know as much about the world as possible. However, we will now attempt to determine whether or not it is possible to have at least some reasonable certainty that our theories have some accuracy about the world beyond the merely phenomenal level.

Let us begin by considering the way we might intuitively conceive of a simple box. Our perceptions of it, we find, can be organized in a succinct fashion by relating them to a hollow cube in a three-dimensional space. Our various perceptions can then be explained by geometrical laws of perspective. Can we therefore conclude that in the world there are, in addition to our various sensations which we

organize together to form our idea of ‘this box,’ also some objects which are at least approximately a hollow cube in a three-dimensional space?

In order to answer this let us begin by considering the alternatives. First, suppose that the atomic theory is in fact ontologically significant; after all we have admitted already that there must be some sort of controlling principles over our sensations. Now according to this theory the box is not in fact a cube, but rather something approximately cubical which is really composed of point particles called atoms, which do in fact reside in a three-dimensional space. At first glance it seems that our box-notion must be simply discarded. Yet upon further consideration, it must be noticed that these atoms are formed into a shape which is approximately a hollow cube. We have not really gotten rid of our initial notion of the box, but rather simply said that rather than being fundamental, it is an approximation. But it is not merely a convenient tool for computation, but in fact an approximate description of the ontological facts expressed by the atomic theory. Therefore it retains ontological significance, although it must be admitted that it is only accurate up to some level of approximation.

Of course, the atomic theory has now been superseded in physics by quantum field theory (Peskin, 1995). Although this theory involves rather complicated mathematical constructions, we may intuitively think of it for our purposes as saying that individual particles are not particles at all, but instead excitations of a quantum field, rather like the vibrations of a string. However, they are ‘quantized,’ in that the amplitude (height) of such vibrations is restricted to being a number among some discrete set of numbers rather than being allowed to be any non-negative number (in fact, there are further interpretational issues that are involved in quantum theory, but for our purposes this suffices). Does this change the situation above?

In fact it does not. The atomic theory comes out of quantum theory as an approximation, for these excitations of the field behave, under appropriate circumstances, very much like point particles, as long as one ignores very small-scale behaviour. And as we have already discussed, our intuitive idea of a

box as a hollow cube is accurate as long as we ignore the small-scale irregularities in the box. Therefore if quantum theory is ontologically significant, then so is atomic theory, and hence so is our intuitive notion of the box, although of course at each level we do introduce some level of approximation.

However, to answer our question in general we cannot restrict ourselves to the mere consideration of whether our intuitive notion of the box retains ontological significance under the assumption that some specific theory such as quantum theory has exact ontological significance. For after all we cannot be sure that any given theory has such significance; that is the very problem we are trying to surmount. Let us therefore borrow a technique from Descartes (2006). We will suppose that our perceptions are being produced in some arbitrary way, possibly even being produced in such a fashion as to confuse us as to the true nature of the world. Do any of our theories still have any kind of ontological significance?

Return to the box. As far as we can tell, our perceptions can all be accurately predicted under the theory that they are correlated with something that behaves like a hollow cube in three dimensions, from which our visual perceptions are derived by the geometrical laws of perspective. We wish to consider seriously the possibility that the actual manner of their production bears as little resemblance to this as possible. On the other hand, whatever these means of production really are, their *consequences* are certainly able to be described as a hollow cube under the laws of perspective. Now whatever consequences the controlling principles have, those consequences are related back to the principles themselves by the very fact that they control the consequences. It follows that there is some portion of these controlling principles which together act in a manner which can be described, at least formally, by the laws of geometry and perspective with a hollow cube. Even if we were being deceived by Descartes' evil deceiver, still that deceiver must carefully keep track of what perceptions to produce in us in a manner that those perceptions arise *as if* produced by something which can be described as a hollow cube, and therefore which *can*, at least in part, be approximated by a hollow cube.

Therefore our intuitive theory of the box *does* retain some level of ontological significance. It does not necessarily mean that the theory is entirely accurate, but insofar as we have compounded together a collection of perceptions into some succinct description, and insofar as the controlling principles in the world produce those perceptions, then those principles act together to produce perceptions which admit such a description, and so the principles themselves admit that description, at least as an approximation of a portion of them.

IV. The Importance of Empirical Content

What we have concluded then, is that we can have some reasonable certainty that our theories have ontological significance. Whatever the real principles may be that control our perceptions, our theories must describe at least a part of them with at least some degree of approximation. But there is an important exception to this which we did not see in the above example, and is best illustrated by an example from history.

The history of electromagnetic theory is very rich, and a full description of it would take us too far afield. For a more detailed discussion of its history we refer the reader to the original papers on the matter in (Jeffery et al., 1952). For our purposes, the following summary suffices. The physicist Maxwell wrote a description of electromagnetic theory which involved the speed of light, commonly written with the letter c . Physicists therefore posited the existence of a medium in which light waves propagated, in analogy with the theory of sound. After all in the theory of sound the speed of sound in a medium plays a role, but this speed must be relative to something. For sound, it is the speed relative to the motion of the medium. A similar medium, named the *aether*, was proposed by physicists. Therefore they predicted that motion relative to this aether should be measurable. However, experiments showed that such motion could not be detected. Lorentz therefore modified the theory of the aether so that motion with respect to it could no longer be detected. Einstein realized therefore that there was no

reason to keep the aether as part of electromagnetic theory, and showed that it was entirely unnecessary to keep it as a term in the theory.

What this example shows is that we can only have reasonable certainty that the terms in our theory have some degree of ontological significance when they are *necessary components for some empirically testable predictions*. The aether had become an empty term in the theory of electromagnetic, and hence there was no reason why it should even be a part of the theory at all. As a consequence, although there might be something in the world that corresponds to an aether, we have no reason to think that such a term in the theory corresponds even approximately to any thing in the world.

Recall after all that in our above discussion of the box that we concluded that there must be something in the world which behaves approximately like a hollow cube in three dimensions on the grounds that our perceptions are governed as if there was such a thing, and so the governance itself must be describable in such terms. But with the aether, the experimental consequences of electromagnetic theory were found to have no dependence at all upon the aether itself. As a consequence we cannot apply the reasoning that we did to the box. There is no need to say that the ‘true’ principles governing our experiences related to electromagnetics have any resemblance to the aether, because electromagnetic phenomena are *not governed as if* there was an aether. Therefore it follows that we can have reasonable certainty that the terms in our theories have some ontological significance *provided that* those terms form an essential part of the empirical predictions of that theory.

In summary, then, we have found a sufficient condition to think that a given theory has ontological significance. Namely, as long as our perceptions behave not merely as if there were such and such a thing, but as if governed by such and such a thing, then the true governing principles must bear at least some approximate resemblance to that thing. Of course, since we have said that every existing thing can in theory be directly perceived, then every term in every theory makes some empirically testable

prediction. But in practical terms, only those predictions which involve the experiences which are achievable for minds ‘in our position,’ so to speak, can be treated in this method. Even with this restriction, however, our criterion will allow us to have reasonable assurance that our theories yield at least approximate, if not an exact, descriptions of those entities responsible for our perceptions.

There is one point of importance to note here: in most scientific theories, there is no speculation about the causal nature of the structures involved. In other words, one usually encounters scientific laws in the forms of correlations, and nothing more (Russell, 2005). But these laws must involve some sort of causal or controlling power, if the correlations are not to be mere accidents. This does not mean, however, that the terms involved lack ontological content. It in fact means that the true metaphysical situation must include not merely approximations of those terms, but additional causal relationships between them as the ground for those correlational laws. This fact will be used later in our analysis, particularly in our analysis of physics.

V. Applications

The first application we will consider is to theories of metaphysics. Recall that in section I we discussed thoughts, and noted that while in every thought we can distinguish the content and the awareness involved, this by no means indicated that there was any such thing as a ‘mind’ in the traditional sense. But now we can note that thoughts are in fact organized into these large collections with the same consciousness, or at least consciousnesses so interrelated that we consider them essentially similar, as we consider different perceptions of green to involve essentially similar content. Insofar as this is true, then, there must be some kind of guiding principles in the world which guides these events of thought to have the same consciousness involved in each of them. These principles might not turn out to be very much like the simple ‘mind’ of traditional metaphysics, but the traditional theory of the mind certainly approximates these principles to some degree. Of course this does not tell

us exactly what these principles are comprised of, but they certainly do work together to form something which is approximated by the traditional notion of a mind.

Now if we consider the behaviour of other humans, their behaviour so mimics ours that it seems entirely unlikely to us that there should not be a mind correlated to their bodies as our mind is to our body. But we cannot perceive their mind, at least in our state (though in principle nothing we said in section I forbids it). In fact herein we find a situation to which our principle cannot be applied in practice. In our above considerations we said we can be reasonably confident that our theories have ontological significance whenever those theories only have terms which relate directly to our own experiences. But here we see a situation where we feel reasonably certain that our theory is significant without the approval of our criterion. We could after all say that other people do not actually have conscious experiences, but only behave as if they did. Adding 'consciousness' to our theory of other people does not make even the slightest change to the predictions we make which we can actually test (in our current condition). Yet it seems that very few would seriously doubt that others have experiences. The degree to which such analogous reasoning should be admitted is not entirely clear, and is open to a great deal of debate. For example, should we apply similar analogous reasoning to animals? We will not consider this problem here; our only concern is to show that there are least some cases wherein our theories may be reasonably considered to have ontological significance. Our point here is that our criterion found in sections III and IV is a sufficient condition for us to think that the theory has ontological significance, but it is not a necessary condition. In some cases where our criterion cannot be applied, we might find other reasons to think that there are terms in a theory with ontological significance. The case of the minds of others is an example of this: our reason for accepting that other people have minds like ours is not based upon the criterion here, but rather upon the desire for a degree of symmetry (here we mean 'symmetry' in the sense that we think that similar things should be correlated with other things in similar ways). It would seem strange, that is, if only some

bodies had conscious events associated with them and not others, when they have such close similarity. Thus we might add another criterion for thinking that a theory has ontological significance: if assuming that it does so vastly increases the symmetry of our picture of the world, then this might be taken as a reason for assuming it has ontological significance. But this criterion, though perhaps convincing, is perhaps not as convincing as the criterion stated in sections III and IV.

For this reason, we will focus through the remainder of our exposition on the use of the criterion from sections III and IV for analyzing some specific theories. In particular, our criterion shows us that those theories of biology, such as that animal bodies are made up of cells, have ontological significance, at least insofar as the cells are indeed empirically testable through measurements with microscopes (Karp, 2007). The measurements of animal bodies behave as if they were governed by entities behaving like cells behave for biologists; to that extent, the governing entities must approximate such behaviour. Likewise the theory of quantum fields has some ontological significance, although here we must be a little more careful. Quantum field theory involves certain mathematical structures called ‘states,’ which are used to compute measurable results. These states themselves are not in any way considered to be directly observable. However, since the results may be computed via these states, it follows that there must be something in reality which behaves with at least some resemblance to these states. A more detailed analysis would require us to entertain a highly technical analysis of quantum field theory, which is beyond the scope of this paper.

However, there is one aspect of quantum theory which no metaphysical analysis can ignore: the problem of superluminal correlations (Einstein et al., 1935). Since there are such correlations in quantum theory, which have been verified, we may be reasonably certain that there are ontological principles which cause them (Aspect et al., 1982). That is, in quantum theory, superluminal correlations are predicted, and these are verified. Therefore the governing principles of experience must at least approximate entities with superluminal correlations. But such correlations, as we mentioned, require

some sort of causal relationship as well.

Now it may not be possible to use such techniques to send messages faster than light, but nonetheless something must enforce these effects. But we hasten to add that this does not contradict the principles of Einstein's theory of relativity, provided that we understand the fundamental point of Einstein's theory to be that the laws of physics should remain the same from any perspective (for the technically minded, this manifests itself in practice as the statement in special relativity that the laws of physics should be invariant under the action of the Poincaré group, and in general relativity as the statement that the laws of physics should be invariant under the action of the diffeomorphism group). While this theory does seem to suggest that there should be no superluminal causes, that is something additional, beyond the essential statement that the laws of physics should remain the same from any perspective. The precise implications of this are not yet well-understood, and in fact the interpretation given here will perhaps be somewhat controversial. Nonetheless we maintain that we can have some degree of certainty that there are such ontological causes, by the criterion that we have found.

While we are mentioning the theory of relativity, we find that it also presents us with two good examples of the application of our criterion. Until Einstein, physics regarded space as being described by Euclidean geometry. Einstein realized, however, that it was better described as being 'curved,' rather like the surface of a sphere. But our idea of space as Euclidean retains an approximate ontological significance, since the curvature that Einstein introduced is quite minor. And even if at some point Einstein's theory is superseded, even if the notions of space and time as they now stand are at some point replaced in physics as fundamental entities entirely, his description of space and time as curved will always retain *some* approximate degree of ontological significance, insofar as our perceptions do behave as if governed by something describable by curved space. For a further discussion of these matters see (Misner et al., 1979).

VI. The Pragmatic Consequences

With all this said, does it matter whether or not we ask that our theories should have ontological significance? We might after all get along just as well for most practical matters with a theory which is merely a computational convenience. When we design a bridge, it does not matter whether the principles governing that bridge should be describable as a semi-rectangular block, as long as the bridge does not collapse under us.

Now as we alluded to before, we as human beings, or at least some of us at any rate, have an inherent curiosity about the world. We wish to not only predict our experiences but to know what is behind them. Therefore, even if there were no other benefit to trying to make our theories ontologically accurate, such a result would still be desirable in itself.

But we contend that there are further benefits to such an attempt. Let us return to the example of electromagnetic theory and the aether alluded to before. It was because Einstein realized that the aether was no longer a useful part of electromagnetic theory that he was able to consolidate the theory in the way that he did. Of course it could be claimed that we do not need to refer to ontological significance in order to perform these consolidations, but rather we need only look to simplicity of computational convenience. In other words, we could simply eliminate those parts of theories which have no relation to predictive power.

And yet, why should we a priori expect that simplicity should be a criterion of an empirical theory? After all, the world may be a very complex place. Without some additional assumption, the idea that our theories should be simplified has little justification. Nor is it clear why a theory which yields correct predictions at one time should continue to do so without some additional metaphysical assumptions.

Therefore, while it is theoretically possible to have theories which accurately predict our

experiences without any consideration of their ontological accuracy, ignoring the ontological accuracy leaves us without any conceptual justification for the theory. It may be that such justification is not held to be necessary, but at any rate it seems to be something which we desire, and if we seek it, then many of the pragmatic points which we find necessary (such as eliminating those parts of theories which make no change to the predictions of the theory) follow naturally.

VII. Conclusion

We have enquired as to the degree to which we may have a reasonable assurance that a given theory is not merely a computational convenience for predicting our experiences, but furthermore has at least some degree of ontological accuracy. After first considering why this question should be thought to be meaningful by presenting some preliminary metaphysical considerations, we explored the question itself through some examples. Through these we came to formulate as a general principle that if a collection of empirical results have a form that seems to be governed in a certain way, then that governance must be at least approximately accurate, even if there are other components to the governing entities or those entities are only approximate formations of yet other entities. However, we restricted this principle to those portions of the theories which are explicitly involved in empirically testable predictions, since we have no reason to suspect any portion of the theory which produces no results to have any ontological significance.

From this principle we were able to analyze some theories of science, at least on a general level. In addition we were able to show that certain metaphysical notions, such as that of the mind, must have at least some ontological significance as approximations. Our analysis showed, however, that our principle is not adequate to justify all of our beliefs. For example, to justify the fact that we believe other people to have similar conscious experiences to our own, we are required to appeal to some other principle, such as our intuition of symmetry: similar appearances should be connected to similar

correlates, unless there is a good reason to think otherwise.

Lastly, we have shown that this question is more than merely a matter of intellectual curiosity, but that it should in fact help us to develop theories which have pragmatic benefits in terms of their predictive power. More specifically, many of the pragmatic methods which are beneficial to the formation of empirical theories become natural consequences of the attempt to formulate theories with ontological significance.

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