

**EXPLAINING CONSCIOUSNESS -
POINTERS FROM PHILOSOPHY
OF MATHEMATICS**

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NIAS Working Paper WP2-98

1998

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ABSTRACT

A fundamental problem in consciousness studies arises from the ambiguity in conceptualizing the real, abstract and the differences between them. Philosophy of mathematics is a field of enquiry useful for clarifying this distinction. The foundational questions in philosophy of mathematics are similar to those in the study of consciousness thus allowing for an inter-disciplinary dialogue between these two disciplines. In this paper, it is also argued that a strong reductionist position on categories like consciousness and experience is inconsistent because of the reductionist's tacit acceptance of ('experience-like') abstract entities in scientific theories. Philosophy of mathematics has also developed numerous ways to understand how knowledge of acausal abstract entities is possible. I summarize a few of these approaches and place them within the context of consciousness. Finally, I argue that the nominalist approach, following Field's attempt to nominalize physics, is one possible way to be a consistent reductionist about consciousness.

There are two fundamental questions in the philosophy of mathematics which are of relevance to the study of consciousness. One is whether abstract entities¹ exist and two, since they are abstract, acausal, not located spatio-temporally and so on, how is it possible for us to have knowledge about them. Both these questions have been dealt in detail in the philosophy of mathematics and the main impetus for this has come from Benacerraf's seminal papers in this topic (Benacerraf, 1965; 1973). I believe that some of the approaches towards answering these questions can illuminate and clarify certain fundamental issues in the study of consciousness.

In consciousness studies, there are two foundational questions which are philosophically very similar to Benacerraf's posers. These questions are whether 'something' called consciousness (and/or experience) 'exists' and if so, since it is acausal, non spatio-temporal and so on, how can we have reliable knowledge about it?

Answers to these questions range across a wide spectrum. To facilitate further discussion, I shall term, as many do, reductionists as those who do not believe that there is 'something' called experience² and the non reductionists as those who believe in experience as the defining, non-materialist aspect of consciousness.

The heart of the problem lies in the definitions of real and abstract. Philosophy of mathematics, in particular, has dealt with this question in detail. In this paper, drawing upon some results from this field, I shall give reasons as to how one can reasonably hold onto a non-reductionist position because of an *inherent inconsistency* in the reductionist position based on the neurobiological approach. In the final section, I shall suggest the outlines of a program of nominalization which follows Field's program of nominalizing mathematical physics. I believe that this approach will allow one to be a consistent reductionist both towards abstract entities in science and those occurring in the field of consciousness.

The philosophical problem regarding the existence of mathematical entities is quite simple and can be basically summarized in the two questions given above. Widely differing positions arise in response to these questions; platonism and fictionalism being two strong representatives. Platonists about mathematical entities are those who believe that mathematical entities like numbers, sets, functions and so on exist independently of us. Fictionalists believe that mathematical statements are akin to fictional statements - they are true within the received story of mathematics. This nomenclature is useful across disciplines and one can see that the non-reductionists

are platonists about experience (and consciousness, in general) and the reductionists, at least the hard-core variety, are fictionalists. The gap between these two camps seems to be unbridgeable and goes beyond the problem of whether existence 'exists' or not.

An important motivation for a nominalist approach lies, in my opinion, on the *impossibility* of rigidly holding onto a reductionist doctrine while constructing a 'science of consciousness'. It is not difficult to see why. *A reductionist who believes in the efficacy of scientific theories of physics, chemistry and biology to explain consciousness is implicitly being a platonist about the abstract entities that abound in these theories.* A reductionist like Dennet who rejects experience calling it a myth, does so because of certain abstract characteristics associated with experience. But even as he does this, he allows for an ontological commitment towards 'similar' abstract entities arising in the neurobiological approach. He may, of course, argue that there are sufficient reasons to believe in abstract entities which arise in these theories. But this conclusion does not quite follow as is well known from the literature in philosophy of science.

Although I shall not go into these well known arguments, I shall give examples of how 'experience-like' abstract entities³ occur in science. This means that the reductionist who denies experience as an ontological category, is at the same time making ontological commitments to similar entities in her/his scientific theories of consciousness. In such a scenario then, the denial of experience needs to be reexamined.

Does this mean that the reductionists cannot take a consistent position within the framework of the scientific theories of consciousness? They can. I see nominalism in the case of mathematical entities, described by Field (1980, 1989), as the candidate for a *truly reductionist* approach. What Field and others have attempted to do is to nominalize physical theories. This allows one to work with these theories without having to believe in the existence of the abstract mathematical entities which occur in them. Recently one such approach has been attempted by Balaguer (1996) for Quantum Mechanics. I believe that to find a *consistent* footing for a reductionist position on consciousness, one may have to take recourse to such a nominalistic view of consciousness.

I: Abstract Entities in Science

I think it is quite clear that in the scientific theories which underlie the neurobiological approaches to consciousness, there are more entities which are abstract and, in a sense, on par with experience, than there are real ones! Knowledge, whether in physics or in theories of consciousness, *by its very nature* instantiates abstract entities. I shall not try to enumerate all types of abstract entities intrinsic to the scientific theories nor go into the detailed reasons why one needs to hold this position.

The simplest example of abstract entities in science is that of numbers which are surely the most basic of mathematical entities. Implicit in our use of them, is an ontological commitment that numbers exist as independent objects. Numbers are somewhat analogous to experience. They are acausal, non spatio-temporal, can conceivably have no contact with us in the usual sense and so on. They also seem to be contingent to physical facts or processes, like experience is. Chalmers' (1995) question as to why there should be experience contingent with physical processes can be rephrased to one about why numbers seem to be contingent with physical facts. One may respond that we do not really believe that numbers exist but only use them in a specific manner. This statement would be false for a scientific realist. Whether we believe in numbers when we use them or not is not the issue here. Even if we don't believe in the existence of numbers, the structure of the scientific theories makes a *logical and semantic commitment* to a belief in them as independent objects. In effect then, the reductionists who swear by the scientific theories allow for the existence of numbers while not making a similar allowance for experience. Such a conclusion is not only for numbers, it holds good for all mathematical entities we use in our scientific theories.

There are also simple examples from science - heat, for instance. Given that we allow for real molecules moving around with some kinetic energy, we can still ask, why is there an entity like heat which accompanies these physical processes? Do we make an ontological commitment to entities like energy and heat? Energy is an 'entity' which is non spatio-temporal and doesn't exist in the same way that physical objects do. Kinetic energy, for example, is contingent to the object and defined in terms of the mass and velocity of it. So we may well ask, why does this creature called energy accompany the physical processes of objects in motion (or at rest)? Should they be seen on par with abstract entities like experience?⁴

Photons and phonons, for example, belong to a different set of examples. How is a massless photon real? It is not spatio-temporal in the particle picture and as a wave

it is equally problematical as far as the criteria of reality are concerned. Lowe (1995) suggests that waves cannot be considered as abstract objects because of indeterminate identity conditions. One can perhaps argue that there is some kind of causality associated with them but this is also quite unclear. Maybe there are no such things called photons. Ian Hacking (1983) mentions a group of physicists who are partial towards this view.

Classical dynamics, statistical mechanics, virtual processes, quantum field theory, models⁵ etc., are all examples wherein we make an ontological commitment to abstract entities. These entities exhibit many, if not all, of the characteristics of experience⁶. To stress the point once again, if the reductionists can do this (implicitly or explicitly) in their use of scientific theories then their rejection of an ontological state of experience should be reconsidered.

The reductionist may counter by saying that there are 'good' reasons to believe in these abstract entities occurring in science but no such reasons to believe in experience. The acceptance of abstract entities in physical theories has a lot to do with the belief that these entities are *indispensable for explanatory purposes* and that causal connections can be shown in many cases. This underlies Dennet's (1996) response to Chalmers also. I shall not go into the well-rehearsed critique to this conclusion, leaving the reader to Cartwright (1983) and Van Fraassen (1980, 1989). I shall merely point out that the explanatory models associated with these abstract entities in science are far from providing a conclusive proof for their existence. The models of explanation used to validate physical theories take recourse to bridge principles. These bridge principles highlight the 'gap' between the physical world and theories about it which is essentially the gap between the real and abstract. In this sense the problems with the explanatory gap in consciousness are very similar to those associated with the bridge principles. It is also not quite clear how observations arising from a particular theory proves the necessary existence of abstract entities present in the theory. Duhem-Quine thesis that more than one theory can explain the 'same' set of facts is well known. The logical relation between the set of abstract entities in a theory and its observational subset is a matter which is not only complex but also unclear at the moment. Also, as Field (1989; 14-20) points out, the explanatory role played by physical and mathematical entities are different in character. For these and more reasons, I think one should be wary of making quick ontological commitments to abstract entities based on explanation, observation and so on. In fact, the strongest argument for nominalism

is the possibility of rejecting this indispensability argument by showing that ontological commitment to abstract entities is indeed *dispensable*.

Philosophy of mathematics is particularly helpful in understanding how one can have knowledge about abstract entities. But before I discuss this, I think it is important to identify the philosophical category to which experience belongs. This is because there are many different ways of referring to experience, dependent on which field the definition originates from. Also since there are different 'kinds' of abstract entities, a categorization would help clarify the 'kind' of abstract entity which best fits experience.

Experience as Property

Experience is not only an abstract entity but it also seems to be an ambiguous one, judging from the many meanings bestowed upon it by numerous writers. In my attempt to categorize experience, I shall avoid the many technical details which arises in such a discussion. I summarize my main views here and leave the reader to Oliver (1996) and other references mentioned therein for further details.

I prefer to begin with the primacy of the subject who is conscious - whatever definitions one may have of conscious. Although subject is a loaded term, I use the term 'conscious subject' more as a convenient reference point⁷. I shall suppose, for now, that conscious subjects are conscious because they possess the property of experience along with other neurobiological processes. Experience should thus be thought of as a property of conscious subjects. What kind of entities have properties? One, particulars may have properties and two, properties may themselves have other properties. In this formulation, a conscious subject is a particular which has various properties associated with it. One of them is experience. Experience as a property can and has other properties associated with it. Experience satisfies the adequacy conditions of properties (Oliver, 1996) but the identity criterion must be carefully examined⁸.

If experience is a property then what kind of an entity is it? Properties should be seen as *sui generis* abstract entities. Such entities are what Oliver terms as 'universals'. There are two types of universals - platonic and aristotelian. Universals which have no spatio-temporal location and abstract are termed platonic. (Aristotelian universals have a spatio-temporal location⁹.) Most non-reductionists are platonists of this kind. Experience as an abstract *sui generis* entity which is platonic fits their

conceptualization of it. Various properties may be associated with experience leading to second-order properties.

The above discussion is limited and is mainly an attempt to find an appropriate philosophical category for experience. This approach allows one to gather together the many different, and seemingly arbitrary, characteristics of experience under one category. If experience can be established on this footing, it gives us an easier handle on related ontological and epistemological questions.

Finally, we come back to this question: how can we have sensible knowledge of this abstract entity? In philosophy of mathematics, this question has been asked for all mathematical knowledge, abstract in character. In the following section, I shall summarize some relevant ideas on knowledge about abstract entities. Although the primary focus of this section is on mathematical entities, I attempt to connect it to the question of consciousness wherever needed.

II: Knowledge about abstract entities - Pointers from philosophy of mathematics

I offer this section for two reasons - one, to continue to draw the parallels between philosophy of mathematics and consciousness studies and two, to motivate reasons for going beyond platonism about abstract entities. For this I have to summarize a few possible ways in which one can have knowledge about mathematical entities. Following this, I shall discuss whether such approaches are appropriate in an approach towards understanding consciousness.

The question of what is abstract and what is real and the ways in which knowledge of the abstract is possible has led to many camps among the philosophers of mathematics. The positions range from platonism to fictionalism, as explained before. There are also different kinds of platonism and differing metaphysical and semantic approaches to the abstract. I shall briefly touch upon a few relevant accounts here. The following discussion should be read keeping experience and consciousness as the background theme.

Intuitionism is one of the more popular accounts of how we have knowledge about mathematical entities. Essentially, this is a position which says that we know that there are mathematical objects out there through an innate intuition inbuilt in us. Many illustrious mathematicians, including Godel, have subscribed to this view or some variant of it. This intuition, for Godel, is 'itself a kind of perception'. More forcefully,

Godel also suggests that such intuitions 'may be due to another kind of relationship between us and reality' (As quoted in Katz, 1995; 500). To a mathematical intuitionist, the fact numbers exist is as obvious as the existence of experience to the non-reductionists. (Intuitionism of this variety is a good validation for believing in experience.) But is it enough to say that one has this kind of intuition about these abstract entities? Does this not lead to unacceptable proliferation of abstract entities? Can there be principles to account for intuition about abstract entities?

Jerold Katz (Katz, 1995) argues against such a critical view of intuitionism and posits knowledge about abstract entities as arising out of a priori 'rational reason' alone. He argues that the 'rationalist account of formal knowledge does not depend at any point on causal contact with abstract objects' (ibid; 514). Katz' attempt is to show how mathematics and other formal knowledge are possible even when there is a lack of causal contact with the objects in these knowledge systems. His argument is based on the claim that one cannot talk about abstract entities the way one does of physical ones. The presence of mathematical knowledge only points to a different way of accessing knowledge. And if this leads to the charge of mysticism, he counters it by pointing out that 'our sensory faculties do not exhaust our cognitive faculties' (ibid; 499) and thus absence of some non-sensory phenomena should not be so easily dismissed. A causal, realist account is needed to 'discover' properties of physical objects. In contrast, abstract objects are descriptive entities, are defined to be such and such necessarily, thus making causal contact unnecessary. Therefore, 'knowledge about abstract objects is a priori knowledge, and must be grounded in reason alone' (ibid; 504). Similar arguments can be deployed by the non-reductionists while talking about experience as an abstract entity.

I offer, primarily as an example of the variety of positions on platonism, one more approach towards maintaining platonism of another kind. Linsky and Zalta (1996) set forth their view of 'platonized naturalism' to counter the problems they see in the more accepted form of platonism. Their platonism is 'distinguished by general comprehension principles that assert the existence of abstract objects' (ibid; 525). Somewhat like the intuitionists, they argue that these comprehension principles are a priori. They base their view, as in the other cases, by rejecting the standard ways one understands what abstract objects are. They see in this the dominance of the abstract/physical opposition and 'a piecemeal' approach towards understanding abstract objects. So, the first step in talking about abstract entities is to acknowledge

their fundamental difference from physical ones. This then begs the initial question of how we can have knowledge about them.

But even as we develop new ways of referring to abstract entities, the lack of 'principled reasons' which will regulate the existence of abstract entities and the lack of causal linkages remain problematical. Linsky and Zalta take the view that comprehension principles which allow for a plenitude of abstract objects gets over these difficulties. There are different kinds of comprehension principles, including one which allows for as many abstract objects as possible. I shall only point to their underlying principle of abstract objects - 'an abstract object encodes exactly the properties used to specify it' (ibid; 537). So the number of abstract entities is limited only by the number and kinds of properties one thinks of - 'If properties are the possible ways of distinguishing among objects, and the comprehension principle asserts that there is an abstract object for every group of properties, then there are as many abstract objects as there could possibly be' (ibid; 537)¹⁰.

Neither is the absence of spatio-temporality an insurmountable problem. Lowe (1995), among many others, point out that to be spatio-temporal is just one aspect of existence and should not be confused as the *defining property*. With respect to spatio-temporalness two conclusions follow: 1. Abstract entities cannot be spatio-temporal (necessarily!). 2. 'Ordinary spatio-temporal objects are not the kind of things which could encode properties' (Linsky & Zalta, 1995; 538). The abstract objects are primarily defined by necessary encoding properties. Thus the abstract object necessarily 'fails to exemplify' properties which physical objects do. *Experience as an abstract entity necessarily does not exemplify the properties associated with the material world.*

To the question of how we acquire knowledge of these non spatio-temporal objects, Linsky and Zalta's answer is that since abstract objects are known through the way we define them, the 'cognitive faculty for acquiring knowledge of abstracta is simply the one we use to understand the comprehension principle'. I see this as too easy a way out. But I shall not enter into a detailed discussion of the apriori comprehension principles here. Suffice it to remember that this approach of principled platonism is one way to access experience as an abstract entity.

What the comprehension principle does is 'assert the existence' of abstract objects. The common view of experience as a fundamental entity works on similar lines. Firstly, this idea is predicated on an assertion that there is experience and

secondly, that it is fundamental to our understanding of consciousness. This fundamental nature of experience is akin to the apriori nature of comprehension principles - which, reformulated, will assert that there is experience and that we can know about it in a (synthetic) apriori sense. I cannot comment here on whether such comprehension principles are better than the attempt by Chalmers to make experience as fundamental as mass, charge and so on¹¹ but only point out this to show that other ways of incorporating experience within a scientific discourse are available.

The above discussion gives us an idea of the range of arguments one can hold to justify platonism about abstract entities. In many discussions on consciousness, one finds a similar ambivalence regarding the notion of experience which seems to be based on the real/abstract dichotomy. The non-reductionist view should be seen as a platonist view of experience. Here experience is abstract in the sense that it has no location, no shape, no spatio-temporal existence, out of causal touch and so on. This does not mean that one cannot have specific experiences. These specific experiences are particulars of experience seen as platonic universal. *The fundamental point here is that being an abstract entity does not foreclose the possibility of its existence.*

The reductionists who prefer to see experience as unnecessary, mystical and reducible have as one of their strongest arguments the acausality of experience. But, as argued above, acausality does not say anything about the ontological status of objects which are different from causal, physical objects. Then their argument will have to be that there are not enough reasons to believe in the existence of abstract entities like experience while at the same time, they can point to indispensability arguments as reasons to believe in mathematical entities¹². But if they do this, then they have to be very careful not to attract the charge of being selectively dishonest. The reductionist who puts all her/his arguments into the basket of physics, chemistry and biology while excluding the category of experience must also question how and why they so easily use and accept abstract entities in the physical and biological theories. If they want to be anti-realists about experience then shouldn't they be so about the mathematical entities which so much forms a part of their scientific theories? But if they accept mathematics and its inherent platonism then rejecting the 'reality' of experience is problematical.

I think the important point to note here is that by focussing on epistemological concerns, we take for granted the existence of entities which are used to make the epistemological point but which, by themselves, do not have to *necessarily* exist.

For those who believe in intuitionism (Godel, Hilbert, Connes), in rational apriori reason (Katz) or even the apriori comprehension principles (Linsky and Zalta), it is obvious that numbers exist just as much as physical objects do. Similar arguments in the study of consciousness will make it possible to take a consistent stand on experience. Those who are platonists about experience and platonists about mathematical entities are at least being consistent. Thus the two camps divide as follows: platonists about consciousness and about scientific theories (non-reductionists) and platonists about scientific theories but not about consciousness (reductionists).

This does not mean that one cannot be a 'true' reductionist. I believe that a honest way to be a reductionist is to be sceptical about abstract entities throughout the discourse on consciousness. This means one begins by questioning the role of abstract entities in neurobiological theories and if need be, to be an anti-realist in this regard. Thus the third option: non-platonists about both consciousness and scientific entities (nominalists). Field has done an admirable job in rejecting platonism of mathematical entities while allowing for scientific theorizing. This is his project of nominalism in physics. I believe that a consistent reductionist should believe in some such programme. I summarize Field's nominalistic approach very briefly and suggest ways of extending this to consciousness studies. What I propose here is merely a flavour of the nominalistic approach.

III: Towards a Nominalistic View of Consciousness

What I have done so far is to argue for the non-reductionist position. I have also strongly argued that a reductionist in the mould of Dennet is selectively committed to abstract entities in science while rejecting similar entities in consciousness. I also claimed that to be a full blown reductionist one must take a nominalist position right from the beginning. I shall try and defend this view in slightly more detail.

It is my opinion that intuitionism and what I see as its variants like 'platonized naturalism' and 'rational reason' are still not satisfactory approaches to this problem. The intuitionists/apriorists will still have to clarify why such an apriori component is present in us. It is not clear to me as to how and why rational reason or apriori principles get generated in us, almost as if it is biologically tuned in this manner. Till a better understanding of this arises, nominalism should be given a hearing as a sound philosophical method which may help in understanding consciousness.

Field is a fictionalist when it comes to mathematical entities. He does not believe that there are abstract mathematical entities and sees them on par with fiction: mathematical statements are true according to the received story of mathematics. The strongest reason to be sceptical of fictionalism is the lack of clear explanation as to how mathematics represents the physical world, as it seems to be so effectively doing. This also leads to the indispensability argument that mathematics is indispensable because it not only describes the real world but also enhances our understanding of it. The arguments are discussed in detail by Field and I shall not address any of this except to make the remark that the best way to counter the indispensability argument is to show mathematics is dispensable in our description of the real world. More precisely, it is not mathematics which is dispensable but ontological commitment to the existence of mathematical entities which is dispensable. Such a program has been initiated by Field in 'Science without Numbers'. Field's initial program was to nominalize classical gravity and electromagnetic field theory. As mentioned before, Balaguer has recently attempted nominalising quantum mechanics.

The details are too technical to go into here. I motivate the basic argument and suggest that one should look for a similar approach to the study of consciousness. We have already seen how our scientific theories demand ontological commitment towards abstract entities. The nominalist program rephrases these theories in order to avoid making these commitments. Balaguer's (1996) example regarding length is illuminating. He begins by considering the statement, 'Ralph's boat is fifty meters long'. Here we are committed to a belief in something which is a boat and 'another thing' which is the number fifty and the two are related by an identity condition. Balaguer suggests replacing this thing fifty by finding a physical object with which Ralph's boat is in relation to. For example, one can choose a standard physical object of some length and express the length of Ralph's boat through an operation of concatenation (akin to addition) of this primary physical object. The real numbers then arise as a homomorphism from the set of physical objects. The ontological commitment to this 'thing fifty' is removed in this manner. Balaguer, of course, continues this program further for nominalizing quantum mechanics but still much remains to be done. Rather than delve into the details of this, I shall consider the possible relevance this has for consciousness studies.

The nominalistic approach does not jettison mathematics as we know it nor does it try to replace it with a 'new mathematics'. Basically, what it says is that all

physical information about the world can arise only from the physical content of any relevant theory. If mathematics is part of this theory then all that mathematics does is help 'flush' out assertions about the physical world without adding any 'content' to it. The nature of the physical world does not arise from nor is contaminated by the abstract mathematical structure. This structure only helps one to see the physical information which is already present in some physical context.

But this does not mean that such a mathematical theory is trivial or redundant. It can arise in the physical theory as a premise. It is also useful on these two counts: 1. in 'facilitating inferences' and 2. 'being theoretically indispensable' (Field, 1989; 59). Of primary interest is that it seems possible to *talk about the material world without having to believe in the existence of abstract entities even as we use them to bring forth this information*. I must mention here a serious source of misunderstanding which some scientists have with regard to mathematics. They continue to believe that they use mathematics as a tool and may find this notion of making ontological commitments to mathematical entities quite absurd. The belief in mathematical entities does not come about because scientists believe in them or not. It arises from the structure, logical and semantic, of scientific theories themselves. That is, consciously or not, as long as we use mathematics in the way we do in scientific theories, we are making a logical commitment to a platonism about abstract entities.

How does a nominalist approach like the above help in the study of consciousness? The science of consciousness is a set of broadbased theories on what it means to be conscious. Theories from the physical and biological sciences contribute to this approach. In the midst of all this is the ambiguous presence of experience (or qualia etc.). Experience can find no place in the scientific theory of consciousness. I have argued that experience should be seen as an abstract entity. Then, the question becomes whether it exists in the 'same way' as neurons do. There is one approach, non-reductive, which says yes. The other view, reductive, claims that there is nothing like experience. But the nominalistic view allows us to take a less radical and intermediate position. As a nominalist, I can comfortably say that a theory of consciousness has as an integral part of it, experience, but that our assertions about the world of consciousness does not demand any need to believe that 'something' like experience exists. Thus in following such a nominalistic view the reductionists do not have to make an ontological commitment to experience. At the same time they can 'use' it in order to understand and theorize about consciousness. Like the nominalism

in the case of mathematics, experience too can occur as a basic premise in consciousness¹³ and becomes useful in 'facilitating inferences' and being 'theoretically indispensable'. Through such an approach, the reductionists can go ahead with their project, allowing for experience in the above context without ever having to believe that it is anything more than a comfortable fiction. Allowing for experience means accepting the whole plethora of experiential phenomena as contributing to our understanding of consciousness.

The above discussion is, for obvious reasons, quite a sketchy account of the nominalistic view. But I see in this approach a way to redress the excessive preoccupation of the real/abstract dichotomy present in the debate between reductionists and non-reductionists. It is a programme which must be followed up to show its hidden promise.

NOTES

1. I use entities as a general term and sometimes may be used interchangeably with 'objects'.
2. This also encompasses opinions which claim that experience is a real (in contrast to abstract but existential) category; or that experience and similar entities like 'will' are located in the body. (See Hardcastle, 1995 and Crick, 1994, for example.)
3. Including the defining characteristic of experience, namely, contingency with physical processes. Chalmers continues to reiterate this in his paper - this contingency is what is really the hard problem.
4. There also seems to be a widely prevalent belief that these kinds of entities are just 'concepts' and that ontological commitment to these concepts make no sense. But this is exactly the point which needs clarification. On the relation between concepts and abstract entities, see Lowe, 1995. Shape is another good example of this. What is interesting is that some contemporary theories in physics, topological field theories, make an explicit ontological commitment to entities like shape.
5. I refer the reader to Nancy Cartwright's book (1983) for a more detailed analysis of the role of models and commitments to abstract entities in physics.
6. I would like to reemphasize here that abstract entities in mathematics are similar to experience in some fundamental respects like being non spatio-temporal, acausal and so on. In terms of subjective phenomena, experience seems to be wholly different. But I am not sure one can maintain this, especially with respect to intuitionists, for whom, I suppose, numbers are as real as pain.
7. I avoid using fundamental here for it carries with it a baggage which I want to leave behind. The primacy of the conscious subject has also been stressed by Hodgson (1996) along with experience and 'choice'.

8. I avoid a detailed discussion of the identity criterion but only make the comment that, contrary to some views, this is not as difficult a problem as other existing problems in this field.

9. These universals come with their own baggage of special problems. I am tempted to remark that for those who like to believe that there is a seat/location for will, experience or consciousness, aristotelian universals may fit the requirements.

10. The main problem in approaching consciousness through an approach like this, has to do with the 'strict' identity principle involved in encoding. I do not believe that the identity criterion arising in understanding experience as an abstract entity is problematical, or at least as problematical as other problems are! The main emphasis in Linsky and Zalta's approach is to distinguish exemplification from encoding. Experience can be seen quite fruitfully as an abstract entity under the principles they enunciate. Experience has certain properties associated with it, that is, there are various ways of answering, what does it mean to experience. These properties (second order since they are properties of a property which is experience) can fall into two categories: some of them exemplified and some of them encoded. The comprehension principle will then guarantee the existence of experience as an abstract entity.

11. The primary problem in viewing experience as 'fundamental' is that it is not physical and not causal. Chalmers suggests that experience should be seen on par with mass, charge and space-time as they are understood in physical theories. But in all these three cases, there is an argument for causal links which is difficult to show in the case of experience. Even space-time should be seen as a causal entity. As Field argues, 'space-time regions, unlike mathematical entities, are causal agents' (Field, 1989; 73). There have also been quite a few suggestions in the literature about finding the fundamental laws of consciousness and in general, for making the physical sciences the model for understanding consciousness. I am worried about making this shift to fundamental laws as the new paradigm in consciousness studies. Nancy Cartwright (1983), for example, has pointed to the problems in the 'fundamental' laws in physics. What Cartwright rightly points out through a detailed analysis of these fundamental laws is that these laws never live up to their billing. What is needed instead are a proliferation of phenomenological laws. I believe that this critique of laws in physics

should be well digested before one attempts to do similar things in consciousness studies.

12. Such indispensability arguments are, of course, one of the most powerful reasons for being a platonist about mathematical entities. As Field suggests, all said and done, the best way to counter this argument is to show the dispensability of these entities. More on this in the section on nominalism. Such indispensability arguments abound in the general case of abstract entities also. For example, Lowe posits the ontological necessity of such abstract entities by pointing that some such objects 'need to be invoked for explanatory purposes' (Lowe, 1995; 516). I see this as another indispensability argument. My basic problem with these approaches is my belief that it is philosophically troubling to tie ontology to epistemological categories.

13. This is obviously very different from Chalmers' suggestion that experience should be seen as a fundamental entity from which fundamental laws follow.

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