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Physicalism and Emergence

Abstract: *Physicalist theories of mind are usually taken to imply causal closure in the physical domain, which implies that physical events are wholly determined by the physical principles governing the context in which they exist. This leads inevitably to some form of reductionism or epiphenomenalism when applied to the neurophysical correlates of conscious experience. If intentionality, characterized in terms of an operative consciousness, is to have any purchase on physical reality then its action must have distinctive and objective structural features that are inconsistent with causal closure yet compatible with a non-trivial broadening of the concept of physical principle. The paper seeks to present such characteristics. Further, denial that conscious intentionality is ontologically fundamental is argued to be inconsistent with a basic assumption concerning the nature of scientific theory itself, the so-called scientific paradigm. In general, progress in these problems has suffered from an inadequate formulation of the concept of emergence which we attempt to rectify, defining a form of it appropriate to individual intentional acts. The structural features that must attend any manifestation of genuine mental causation can be characterized in terms of the time-coordinated excitations of diverse sites in the brain which resemble an extended time-reversal phenomenology. The argument will be exemplified by appeal to speech generation.*

Section 1: Introduction

Consciousness has an essentially dual character. Consideration of its passive, registrative mode leads to a discussion of qualia, the experiential, qualitative, 'feel' of things. The active mode concerns its impact on the world in creating new order in the form of either behavioural or physical structure. In this paper we treat only the latter issue,

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tackling the question: can the action of consciousness be characterized *distinctively* in the activity of the physical world in general and the brain in particular? The very formulation of the question suggests a switch in the metaphysical focus from states to operations. Intuitively the nature of conscious mentality is to 'preside'. That is, it can be presented in the abstract as instantiating a registrative/operative function. Of course there is more to consciousness than this, for such a function can be readily implemented in purely physical terms. In trying to pin down what that 'more' could be we have to relate discussion to the current model of reality. In this paper the word 'ontology' will crop up with some frequency. It refers to the kind of being something has. Thus a particular concept might have the status of a convenient idea, a mere mental classification, with no objective foundation in reality. Alternatively it may express a conviction that a definite 'something', not necessarily a narrowly material something, has to 'lie behind' some pattern of events. The word 'metaphysics' gets quite an airing as well, and our use here is one of reference to ontological issues.

So we want to understand the ontological place of operative consciousness in our model of reality. To begin we need to examine just what we mean by 'reality'. There is an underlying, unspoken assumption about what has come to count for us as existential bedrock, namely that at bottom 'reality' is stuff in space, evolving and interacting in accordance with the laws of physics. The implication is that, according to this prevailing materialist paradigm, all operative functions are held not to require any further ontological basis than that which can be described in terms of those laws. Ontological status then favours objects rather than operations. Any essential operative character tends then to be hidden by the fact that the laws of physics are formulated mostly as statements of rates of change of properties of identifiable things. Hence it is natural to give ontological priority to objects as things that occupy space and persist. In consequence the ascription of distinctive 'reality' to, for example, the mind and its experiential content tends to call up the spectre of Cartesian substance dualism. This unfortunate tendency continues to haunt discussion of the mind–body relation. An exorcism might be at hand if we are prepared to recognize that a persisting operative potential has a definite and objective reality different to that of a persisting physical entity. We need a more sophisticated ontology, a reinvigorated dualism that honours the fundamental complementarity of the operator/operand duality. Strangely enough the denial of metaphysical fundamentality to the operative mode is profoundly at odds with modern physics in

the guise of quantum theory, and has serious consequences for philosophy generally.

The contention of this paper is that the idea of discounting the possibility that consciousness may instantiate such an ontologically fundamental function is a bad mistake and has lead to serious confusion. The vital thing is to identify clearly the nature of the operative structure of the putative physical correlates of conscious activity. If physicalism is wrong then that must be evident at the physical level itself. This must differ non-trivially from any account formulated in wholly physicalistic terms. The implications of this can be characterized in general terms not unique to quantum theory. Nevertheless their realization is highly likely to depend in practice on the applicability of quantum-theoretic ideas.

Generally speaking, McGinn's (1989) fear that understanding the nature of the mind–body relation may be beyond us as a species might well come down to the impossibility of housing consciousness in space. The emphasis is very much on what can be visualized. An alternative is conceivable, however, and that is what we attempt to produce here. The ontological status of a conscious operative function might be manifest indirectly in the occurrence in the brain of certain types of physical activity that could not be accounted for in terms of ordinary physical causation. If this were systematically inconsistent on probability grounds with normal physical theory then denial of ontological status to that intentional function would not be an option. 'Something' would have to be producing such an effect. Now, there is another context in which an operative concept has fundamental importance. That is the role of the observer in the structure of scientific theory. These contexts are related by an interesting metaphysical principle. This principle can be understood as a development of that characteristic property of modern physics whereby our concept of a continuously existing material world emerges from patterns of discontinuous actualization of systems of continuously evolving possibilities.

In section 2 the background to the prevailing tendency to reduce the ontological status of consciousness to that of a derivative property of a certain type of physical system will be described and a case against causal closure made. This leads to a practical instantiation of the metaphysical principle we believe to be needed firstly to accommodate intentional activity, and secondly to illuminate the formulation of the fundamental scientific paradigm for both classical and quantum physics. The argument here involves consciousness indirectly in terms of a certain abstract functional role that needs to be filled, yet cannot be

filled in the restricted metaphysical structure offered by physicalist theories. This argument is developed in section 3.

Section 4 relates the basic metaphysical principle to the crucial problem of providing a description of the form of emergence appropriate to intentional behaviour. Various forms of the concept are discussed, including that of *Z*-emergence which is argued to be of particular relevance specifically when made manifest in terms of the generation of non-locally coordinated effects.

In section 5 an example of the ideas introduced in section 4 is given, namely their application to the phenomenon of speech. The argument here considers the specific type of physical behaviour that could be correlated with the presence of conscious activity.

The paper closes with some remarks setting the issues considered in their wider context, in particular with regard to our current understanding of the role of space in our model of reality.

Section 2: General Background

There is general agreement that an objective physical world exists and that it contains beings who believe themselves to be conscious agents. It is not, however, generally agreed that consciously willed actions have determinantal effect by virtue of their intentional content. Rather, their impact on the physical world is widely held to be essentially explicable in physical terms by reference to that activity of the brain with which that content is correlated. This is epiphenomenalism. Other physicalist (e.g. eliminativist; see Churchland, 1981) theories seek to actually identify conscious states with physical ones. We breathe the air of an intellectual climate that gives ontological primacy to a narrowly characterized concept of reality that we identify as 'physical'. This concept of the physical has come to seem to us more fundamental than anything mental. Our concept of objectivity is based on what can be observationally identified as physical. After all, consciousness is a late arrival on the evolutionary scene. In pursuit of physically based accounts of mental phenomena the central concept of classical physics, local causation, is exclusively employed. The term 'local' as used here means proximate in both space and time. The basic idea can be loosely described as 'impact causation'. The laws of classical physics are local in character. Given the conditions that bear upon a physical entity in its immediate neighbourhood its ongoing behaviour is wholly determined, either precisely or in terms of a statistical distribution, by those laws. Classical physics still provides the conceptual framework for most writing on philosophical topics that refer to the

behaviour of physical and organic systems. The sheer effectiveness of this theory in describing, controlling, and changing the world at the level of ordinary experience accessible to the man-in-the-street induces an attitude of metaphysical complacency, a kind of naïve materialism.

It is easy to see why the materialist approach is so compelling. MRI scanning is taken to suggest that the activity of the mind can be actually viewed. Robotics and AI suggest that its activity can be synthesized. Neuroscience suggests that it can be understood without any explicit appeal to 'meaning'. Inevitably a picture emerges of a world that can be accounted for in terms of physical concepts alone. That world is causally closed. Physical events have physical causes, and there is no way in which intentional content could find determinantal purchase on that world. Minds ride haplessly on the neuronal dynamics of the brain, mere epiphenomenal passengers. Allowing the mental *qua* mental to have direct expression in, and therefore direct effect on, the physical world seems to reduce to belief in spoon-bending. This kind of view, of course, clears the way for a fully neo-Darwinian account of the development of mind presented thus in essence as a purely physical organ. An immediate consequence is that, at least in principle, actions are the products of causes rather than reasons. There can be no *ultimate* role for the concept of purpose, apart from its apparently unavoidable use as a source of metaphors in texts advancing the various physicalist theses.

In a way this is an odd state of affairs. As has been frequently asked — why should consciousness have evolved if it was powerless to influence events in the physical world? The standard response is that consciousness is the 'felt effect' (Gendlin, 1982) of physical information processing in the brain supporting better survival and breeding chances. But the obvious rejoinder is: why should there be any kind of 'feeling' associated with such processes if the real business is done at the objective physical level? What does consciousness actually *do*? Why should minds have continued to evolve? And in particular, why should those minds have themselves evolved the tool of language if the ostensible, non-local, structure of language is so apparently different from the causal dynamics of its physical substrate in the brain? Now, a non-philosopher reading the foregoing would no doubt wonder what all the fuss was about. Our conscious lives are hugely caught up in the business of either worrying about or wanting 'what might be but isn't', and trying to create an acceptable 'what is'. The evolutionist might well agree, at least when he is not in thrall to out-and-out physical reductionism.

We can agree. Minds analyse and process possibilities and they register and initiate actualities. And it is reasonable to suppose this to have significant adaptive value in the evolutionary context. Admittedly this kind of characterization of the activity of consciousness seems to be at odds with the conclusions drawn from the experiments of Libet (1999) and others. The point here lies in a marked difference of context. We are considering the operational activity of mind in meaning-laden contexts, whereas Libet concentrated on meaning-free contexts. It would be no trivial task to design Libet-type experiments in contexts where the relative times of geometrically diverse meaning-creating responses was observed. Further, Libet himself accepts a negating capability to consciousness (the famous 'free won't') that can override the unconscious prefiguration, and this, should all else fail, could support an essential role for conscious processing. Even so the underlying problem remains. Can the action of consciousness in generating meaning be distinguished in some specific structural manner in the overall physical activity of the brain in a way that is incompatible with physical reductionism?

It is easy to see that this raises the matter of 'causal closure', an issue on which the advocates of physicalist theories have decided views (see, for example, Kim, 2005). By causal closure we mean any theory that requires its bedrock account of the world to be given wholly in terms of the principles governing the interactions of material entities. Nothing else is allowed to have any essential role in accounting for what happens. There can be no fundamental role for any concept of intentionality.

So any non-epiphenomenological, non-physicalist theory of the action of the conscious mind must exhibit a structural inequivalence at that bedrock level. To see how, we need to examine the idea of causal closure and imagine how it might be 'opened'. Suppose there is an 'operator', that can be stimulated to generate a response to the action of its environment upon it. The operator registers the state of its environment and responds accordingly. If, for any particular and unprecedented condition of the environment, there is precisely one response associated with that condition that is open to the operator the overall situation is fully deterministic. The response is uniquely determined by the prevailing physical condition and the situation is causally closed.

Next we consider two types of case for which the uniqueness property fails. Suppose that even given complete specification of the environmental condition there is a subset of equally likely responses open to the operator (the requirement of equal likelihood is made for

simplicity; the argument can be adapted to a general probability distribution). It is as if the causal condition individuates but cannot discriminate differences in the operator's internal structure that decide particular outcomes. Though the environmental condition stimulates a response, it is not uniquely determined; the precise causal link is broken. However, if the operative response is random within this restricted range we may still say that the action is compatible with causal closure. This is something of a default classification but the randomness of the response implicitly excludes any more specific explanation finding purchase on the matter.

Now, suppose that in the second type of context the outcome is non-random when there is no physical reason why it should be. The operator initiates a structured response. Explanatory purchase on the response may exist, but originates somehow in the structure of the operator, and so independently of the environmental stimulus in this case. It is a case of *creatio ex nihilo* in the structural rather than material sense. This opens the way to the characterization of the content as intentional. A minimum conclusion is then clear. The causal link between the stimulus and response must evaporate into discontinuity. Anything short of this renders the 'operativeness' of the concept ontologically vacuous. Causal closure must fail if intentionality is to be other than a nugatory concept. Energy conservation can of course be respected.

The possibility of real interest to us is that in which the operator's response arises from the initiation of distinct but convergent causal sequences either stimulated by the environment or generated internally but with no single, common source. Indeed this is more than a possibility; rather it is a necessary structural feature of any world in which meanings and reasons are to be other than useful shorthands for the actions of physical mechanisms. If the abstract 'operator' is identified with the brain then there must exist patterns of activity in the brain the excitation of which are not sourced from a common location in the internal geometry. Their development in time converges collaboratively to produce simple, coherent, and observable effects. Such outputs are characteristic of intentional behaviour, and a link is suggested to a process resembling a time-reversed film, an 'unscrambling of the egg'. Physically the situation is one in which available energy is manifest in a spectacular increase in the local dynamical order-structure.

It is of great interest here to compare this approach with that of Dennett (2003). Famously and rightly, Dennett denies the existence of a location in the internal structure of the brain where 'it all comes together', and at which an 'homuncular' viewer enjoys the show of

consciousness in the Cartesian theatre. His analysis, however, illustrates the point already made that too much attention is paid to the problem of understanding qualia or passive consciousness, in terms of its 'location' in the brain, and too little to the operative function of consciousness. He is undoubtedly right in stressing the spatial, and temporal, diversity of relevant brain activity in the registration of environmental information. But he ignores the hugely significant corollary that there is no point from which it all originates. The highly structured output to the environment associated with conscious sources must result from the excitation of spatially and temporally diverse locations in the brain, and these are not triggered from any single point of origin either in general or specific to the particular context.

Now, it is wholly possible that a complex organism might evolve strategies coding for such effects at single sites. But recall that we are supposing an unprecedented input; there is no chance for anything to evolve. This point is crucial. The coherent and spontaneous resolution of such states indicates the presence, indirectly, of the active agency of a non-local order-creating function. The signature of any such presence is diverse, highly structured activity converging to produce localized output to the environment. Such a resolution would be manifest as a non-local, time-coordinated, correlated activation of diverse physical sites creating effects converging to produce a localized and purposive final output. Each such manifestation could be understood as the spoor, or trace, of an intrinsically purposive agent. For in the absence of such agency the issue could be at best a random collage of unordered outputs.

We are led to discern in the fabric of nature a principle of independence, a kind of metaphysical 'fresh-start' principle whereby new order-structure, and order-creating processes, originate in, but are not determined by, the context of their birth, creating a future that is genuinely open. We shall argue shortly that this idea is a *sine qua non* for the scientific discipline itself. Beyond this we need an extension of this principle to the intentional domain. The existence of a generic high-level order-generating principle could then be taken to be a characterization of a non-epiphenomenological theory of consciousness. The present paper consists essentially of attempts to relate this idea to the structure of actual functions of consciousness by looking both at why it must, and how it can, be implemented.

Materialist philosophies tend to respond to such considerations by invoking the concept of emergence, whereby a property may be possessed by a system but not by its parts (the definition given by Bunge,

1977, for example). Their claim is that consciousness is manifest as a collective behavioural phenomenon made possible by the complexity of the neurological substrate. In general, emergence of a kind of behaviour, observable at a macroscopic level, is held to be irreducible, inherently unpredictable, from knowledge of the individual behaviour of the elements of that substrate. Of course the higher-level behaviour cannot be incompatible with the physical laws governing the lower-level elements, but crucially no new principles are held to be required. Causal closure continues to hold. The emergent behaviour simply takes advantage of possibilities inherent in the evolved physical set-up, specifically of the structure of the massive space of possible states of the system arising from the complexity of that system. That is, whilst the new behaviour is conceded to be beyond quantitative reduction, no such concession is held to be necessary to any claim of ontological irreducibility. Objectively speaking the emergent phenomenon is ontologically absorbable into the activity of the existing substrate. No new kind of being underpinning the emergent collective behaviour need exist and we have an example of behavioural emergence.

The problem here is not that the general concept of emergence is irrelevant. On the contrary it is of acute relevance. The problem is that in the typical limited form proposed by materialist philosophers it does not give any clear indication of when it would be necessary and when not necessary to associate new and specific existential status with the emergent function. When applied to the problem of consciousness a simplistic use of the concept of emergence merely amounts to an updated version of medieval alchemy. Out of the base metal of the complex physical substrate there emerges the gold of consciously generated meaning, and no new ontology is held to be required; no new mode of being is taken to be manifest at the emergent level. We need to be precise here. Chemistry does emerge from the physics of the microcosm. The concepts one needs to use to function as a chemist are different from those appropriate to the study of the elementary particles from which complex molecules are formed. But they are of an ontologically similar kind. ‘Emergent gold’ would have new properties but it would have the same kind of being as the ingredients of the alchemical brew. The difference between purely physical activity and that associated with the initiation of purposive action is different in kind and much deeper. The characterization of ‘emergence’ is insufficiently discriminating.

The question of real interest is this. Can we define a universal form of emergence such that particular emergent phenomena may be taken as manifestations of a new and distinct metaphysical structure? Before

tackling this question we discuss an issue in which the involvement of consciousness is structural and functional rather than phenomenological.

Section 3: Physicalism and the Scientific Paradigm

The idea in this section is to draw attention to the incapability of physicalist theories of mind to accommodate essential features of the scientific paradigm both in general and specifically as regards the interpretation of quantum theory. This involves two related matters:

(a) the role of an agent/observer free to set up experimental situations, and
(b) the ontological issues concerning the distinction of possibility and actualization.

Take (a) first. The standard formulation of the scientific paradigm describes a process whereby the theory governing the behaviour of a given system is created and tested. This includes, and indeed requires, a fundamental freedom to set up initial states and register the system's evolution in relation to that predicted by the theory. Yet this role is marginalized, treated wholly informally, as a ghost outside the machine. Consider the unavoidably non-objective character of what we think the material world is like. Its history is one of long retreat from the belief that we observe the world directly so gaining immediate objective knowledge of it, to our present recognition that 'matter' is largely empty space and its substantiality, whilst real enough at a crude level, can only be really grasped in abstract quantitative terms. This means that our working model of objective physical structure is a construct, that it is 'in the mind'. All experimental situations in modern physics are at first constructions in the theatre of the mind. There is a threefold structure involved in this internal drama consisting of observer, experimental set-up, and the physical system under investigation. In the scientist's mind the observer's role is filled automatically. The drama is played out in her internal laboratory. She does not have to observe herself. She makes rather than observes observations. The experimental set-up or apparatus is an adjunct to the physical system under study which enables the behaviour of the latter to be objectively observable by her. To turn this internal experiment into something public the content of the situation has to be mapped onto the external world. This move is undoubtedly correct, but it is fraught with one significant difficulty. The observational role that is naturally, uncontroversially, and privately present to our scientist does not itself

feature in the mapping process, and hence enjoys only a marginal and informal presence in the final model. For the experimental apparatus is not now considered as an adjunct to the objective physical system under study but as the surrogate observer.

The situation is a direct example of the underlying metaphysical stance described in the introduction, that of denying ontological fundamentality to the operative mode. The point being made here is not the familiar one that the presence of the observer affects what is observed in a non-ignorable way. The issue is far deeper. What is stressed is that the 'observer' concept embodies the informal function of registering the transformation of possibilities into actualities. The role of 'mind' in this, as vested in the concept of 'observer', is essential. And its presence implies that the experimental situation, considered in the abstract and as a whole, has a different structure from that of the 'physical system plus apparatus' considered simply as part of the world. The point is that the concept of the experimental situation isolates part of the physical world and treats it as a source of information. This requires the explicit participation of a purposive agent (see Roederer, 2005). And this role cannot simply be delegated to the physical brain-structure of the experimenter/observer.

What is absolutely crucial here is that it is the *intentional content* of the observer's mind that supports the required structural analysis. This cannot be 'physicalized' without destroying the difference between considering, on the one hand, the experimental set-up as simply having happened in the natural course of events, or on the other, as the result of an intentional act. Setting up an experiment is like creating a discontinuity in the smooth evolution of the world. The agent of the setting-up is intrinsically intentional, and intentions, like possibilities, live in minds, not in the material world. But that intention is an essential part of the abstract ideal structure of the basic scientific paradigm. Our contention is thus that the character of the latter cannot be explicitly honoured in the physicalist account. Evidently the root of the problem is our failure to widen our understanding of the nature of objective reality so as to include distinctive support for the structural role played by the concept of intentionality.

In pursuit of this it is useful to consider the 'location' of the objectivity of the experiment that tests a scientific theory. The set-up of that experiment lives first in the imagination of the scientist. Suppose we honour the epiphenomenalist's case by implementing that imagined content as a sequence of objectively observed events omitting even implicit use of intentional features. In this case paradoxically we have to think of the brain-states of the experimenting physicist as of less

relevance than the content of her thought. For it is the conceptual structure of that content that has explicit relation to the objective context of its application. So we just see the items of equipment rising from their disparate places of storage and coming together to form the appropriate apparatus. If we want to know what physicalistic objectivity looks like when observed objectively we must strip its operation of all hostages to purpose. The point of this absurd account is that at some stage in a reductionist metaphysical programme something like this has to be true. (The mathematical reader might think of this as a kind of philosophical version of the 'Intermediate Value Theorem'!) This issue will be tackled in the definition of *Z*-emergence in section 4.

Strictly speaking, the scientific paradigm is also incompatible with absolute determinism, whereby nothing could have been other than it turns out to be. For this precludes the very idea of testing the theory in those situations that were not physically predetermined. This seems nonsensical. Surely the scientist knows in principle that she can set up whatever initial conditions she likes. A full-blown determinist would say: 'No! You only think your choice is independent. In reality the principle of physical determinism applies to your brain as to everything else. Your idea of an operative freedom to set up initial conditions is an epiphenomenological illusion! Be content. The true theory might still be consistent with the results obtained in the experiments you were predetermined to set up. Why is that not enough?' Of course, she would object. The abstract universality of the operative freedom she demands really is essential. Informal though it may be (it does not appear in the equations expressing the content of the theory under test), it expresses the necessary objectivity of that theory. There must be something in the structure of reality that really does underpin the required freedom if the basic paradigm is actually valid, that is, if it is to be in fact relevant to the nature of nature. That conceptual freedom 'lives' in the domain of consciousness. There is simply no way of expressing the matter without making explicit appeal to a conscious intentionality implicit in the 'observer' concept. It can be instantiated in a purely physicalist model only by virtue of introducing some form of arbitrary coding and that would imply an unidentified and gratuitous interpretive role.

So our model of objective reality must include a determinative role for certain specific intentional content. No physicalist theory, be it identity theory or epiphenomenalism, can present the structure required in the absence of the abstract but essential concept of 'observer'. Such a concept must become an active presence in the model of reality. Therefore, we need a better metaphysical model in order to

properly integrate this concept into the objective structure. This issue has been joined by von Neumann (see Schwartz, Stapp and Beauregard, 2005) as will shortly be described.

In modern physics, specifically quantum theory, the plot thickens in a most intriguing way. To make this situation clear we need to draw attention again to the fact that we do not yet have an adequate understanding of the nature of matter, of the ultimate nature of physical substantiality at the level of the microcosm. Even so philosophers, in the main, continue to assume, in discussing the mind–brain problem, that the physical side of things is not part of that problem. The unspoken assumption is that the nature of physical reality is as clear as it needs to be in the context of the discussion. This assumption is unwise.

For in contrast to the situation in classical physics, as already described, the role played by the observer is now promoted to become an integral part of the formal theoretical structure. In this formulation the idea of what the physical system is in itself suffers fundamental change. Whilst it remains a 'something' the nature of its definiteness cannot be described in terms of familiar, macroscopic concepts. Rather, the basic ingredients of the theory are systems of *possibilities*, not persisting entities that are substantial in the usual classical sense. Further, the set of possible states open to even the simplest physical system are not all of a piece. On the contrary they have a structure whereby one kind of possibility can be actualized by a kind of observational set-up appropriate to it while another complementary kind of possibility requires a set-up of a different kind. There is a kind of collusion between the possibility-structure of the microcosm and the condition of its macroscopic setting that has to be honoured in our overall concept of reality. So for von Neumann the abstract, 'classical' freedom to define and set up such an observational system must itself be understood as a fundamental operation, and he labelled it 'Process 1'. Figuratively speaking the operative character of this process can be compared to a choice of language with which to interrogate the microcosmic system. This forces the latter to answer in that language. The system can speak another language but its response to any question will always respect the language in which it is posed.

'Process 2' is the name given to the system's indigenous development in time. The theory describes the way in which the constituent possibilities effect each other and the temporal evolution of that interaction. This is not directly observable. Finally, 'Process 3' describes the partial actualization of the system of possibilities brought about by the system's encounter with the experimental set-up, and launches the system into a further 'Process 2' development.

Now, there is no precedent for this in classical physics. It constitutes an ontologically different way of thinking about the physical world completely incompatible with that of physicalism. Possibilities have a kind of 'kickability' and quantum theory is the mathematical description of it. This has profound implications for the structure of physical theory, and *a fortiori* for reality in general. It is of course a remarkable characteristic of quantum theory that the particularization of one kind of possibility automatically maximizes the range of the other kind, the complementary set of possibilities. 'Observation' is now a creative operation forcing the microsystem into making a certain kind of random 'choice'.

The message is unambiguous. Augmenting the status already demanded by the 'classical' role of the observer, the role in the context of quantum theory carries the essentially intentional element deep into the structure of reality. Processes 1 and 3 in particular constitute a primitive ingredient in our model of reality. They define an overall structure, both necessary and irreducible, drawing on characteristic properties of intentionality that are essential to our objective picture of an 'independent' physical reality at the level of the microcosm. Not only does the observer retain the role of a kind of theoretical '*deus ex machina*', not determined by previous physical events, it prepares the possibility-structure of the physical system. This is in unresolvable conflict with the simple materialist ontology characteristic of physicalist theories of the mind–brain dichotomy. For 'possibility', in such contexts, is a concept that is essentially outside the material world, operationally powerless, in a picture of reality painted with such a limited palette. Recall the aphorism ventured above: possibilities live in the mind, not in the world. So for the epiphenomenalist at least they could have played no role in its physical evolution. But, it might be objected, we have just located possibilities outside minds and in the world as part of the physics of the microcosm! Indeed, and since possibilities can live in the brain only by coding the material substrate for their content, this shows that the 'grammatical structure' of the shared language of Processes 1, 2, and 3 has little chance of being translated into any dialect of physicalism.

There is no doubt that this amounts to something of a crisis, for it appears to make the concept of actualization dependent on conscious observation (Wheeler and Zureck, 1983). That, however, is not the view of choice among physicists in general. It is widely believed in the physics community and by the present author that actualization is indeed independent of conscious observation by humans, that in some way nature 'does it'. If so it will be as an instantiation of a universal

function which is not as yet part of the theoretical structure of physical science. Perhaps the most interesting aspect of all is that when this advance is finally made, though it seems not to be in sight so far, our understanding of the term 'nature' will have to be significantly different from what it is at present.

Of course the original ideas of Bohr broach this issue indirectly with his concept of Complementarity (Bohr, 1954). Interestingly, this view makes the 'classical', macroscopic, observational system conceptually fundamental, arguing that it is impossible to formulate quantum theory without it. This is certainly true at the experimental level, at which mathematical theory meets observational interpretation, in terms of which Bohr developed the idea. But more deeply it is significant that the basic mathematics of the 'innards' of the theory use concepts whose direct physical meaning is defined at the classical, macroscopic level. This suggests an intriguing example of the concept of emergence, and will be considered again in the next section.

We are of course very familiar with one way of relating the complementary concepts of possibility and actuality, namely that which occurs in our own conscious minds as has already been pointed out. There are significant attempts to integrate this with the properties of quantum theory as in, for example, Stapp (see Schwartz *et al.*, 2005). But this approach will not be discussed further in this paper. In the present context we are concentrating on the double failure of physicalism to support current scientific theory and practice and underpin a satisfactory theory of intentionality. We will lay down conditions that any successful theory must meet, noting that it is highly likely that quantum theoretic concepts will be involved.

Section 4: Three Forms of Emergence

Next we turn to the task of defining the form of emergence needed to underpin the phenomenon of consciousness. In general, emergence can refer to the novel appearance of either structure or behavioural pattern in a given environment. We are, in addition, interested particularly in the emergence of operative potential defined on some specific domain of activity. Generally, an emergent phenomenon must enjoy sufficiently robust physical support to underpin its stability. This support can take the form of stable environmental conditions defining the context of the emergent behaviour or of the stability of the relations between its constituents that sustain its structure. In nature this may be provided by an incremental accumulation of structural changes each of which is stable. As earlier remarks suggested, the concept of

behavioural emergence is attractive to evolution theorists because it apparently provides explanatory power at no ontological cost. Emergence is for them a functional rather than metaphysical affair, no new kinds of entity, forms of being, or pre-ordinate organizing principles appearing to be necessary. The subsequent argument will attempt to show that this is too narrow a view. For present purposes three broad types need to be identified, and these will be termed variously *A*-, *B*-, and *Z*-emergence. We do not provide any comprehensive account of emergentist theories, but will be content to describe the distinctive nature of *Z*-emergence which is crucial to the description of operative consciousness.

To begin it is useful to set up a common context in which the different forms of emergence can be clearly understood. Let *E* be an environmental system of interacting entities. Suppose something new appears either as a stable substructure of *E*, a stable pattern of behaviour in *E* , or as a potential to create order-structure in some subsystem *S* of *E*. The condition of stability is important and distinguishes the case of true emergence from that of a chance combination of circumstances. The question of compatibility with the laws of physics is relevant. It may be that the existing laws account for the novel phenomenon, which would then be explicable as a result of the instantiation of critical conditions. The well-known phenomenon of Bénard convection exemplifies this case. Here the effect emerges from the locally random behaviour of liquid molecules manifest at the macroscopic level as a geometrically-ordered, thermally-driven current. Alternatively, the new phenomenon may be structural rather than behavioural. Thus Faraday's demonstration of properties of the magnetic field, stable in the sense of predictable and inexplicable in the then current theory, made the introduction of the new physical concept of lines-of-force necessary.

A-emergence denotes the type familiar in the context of neo-Darwinian, 'bottom-up', evolutionary developments. The emergent phenomenon is manifest in terms of the behaviour of *S* in *E*. This is established by the development of such internal structure of *S* as is necessary to support the emergent pattern of behaviour. There is an operative role associated with this type of emergence, but it is in no way prefigured and is wholly describable in terms of the development of existing structure in *S*. A typical example is the emergence of winged flight from accumulated small changes to fore-limbs. This kind of emergence does not require any purposive operation to generate it, nor is it to be understood as the realization of any pre-ordinate blueprint or Platonic ideal. There is no superordinate '*A*-operator'. It

describes the appearance of a new form of behaviour on an existing but incrementally changing physical base, rather than the creation of any new kind of entity. *A*-emergence is manifest in operational terms, its character being consistent with causal closure and so describable wholly in terms of local effects. It can be described as 'behavioural emergence'. Although the *A*-emergent behaviour may involve significantly new features, the necessary behavioural stability of the intermediate changes is a fundamental requirement. The action of the immune system exemplifies *A*-emergence in a highly ramified form.

B-emergence, in contrast, is taken to describe the realization of a definite latent structure-creating potentiality. Typically, *S* might find itself in an environmental condition conducive to the activation of such a potential, waiting, so to speak, for the opportunity to realize itself. A *B*-emergent is the product of a 'built-in' potential, present either in the deep structure of the world, or in the nature of an evolved entity. A *B*-emergent may itself be an operator governing a process, or an entity or set of entities. The outcome may be either precisely defined (B_0-emergence), or merely prescribed up to some definite restriction, such as required by a conservation law (B_1-emergence). In the latter case the outcome will be only statistically determined subject to the conservation law. The difference may be to an extent semantic depending on how terms are defined.

The most graphic example of B_0-emergence is the universe itself, at least if 'Many Worlds' theories are discounted. The idea here is that the fields governing the different types of interactions are components built into a deep unified structure and are progressively differentiated within in it. Linked to this, and poorly understood at present, is the principle governing patterns of actualization of the evolving systems of possibility. This principle is, of course, continuously at work generating the 'world' we know and live in. A more accessible example of B_0-emergence is that of three-dimensional space in the mind of a child from the multitude of visual impressions experienced in infancy.

B_1-emergence is exemplified by the appearance of protons and neutrons from the free quark 'soup' of the early universe when the temperature had cooled sufficiently to stabilize this phase transition. This manifests the structure of the B_1-emergent chromodynamic gauge field which is in some sense already present in the physical infrastructure. (Internal motions are neglected in this example, the stability of the quark confinement being the focus of interest.) Snow-crystal formation also provides an example of the B_1-type, manifesting the properties of water molecules and the isotropy of physical space. In this

case the B_1-emergent arises from the presence of an underlying symmetry potentially manifest in many possible ways. Of course, the individual crystalline structures are not individually prefigured, each increment in any particular growth process being determined by the repeatedly updated 'initial' conditions and the incremental action of the governing principle. Examples do not have to be explicitly physical, of course. A previously unsuspected talent for, say, cooking, during the late teen years could be considered a B_1-emergent manifestation of latent taste/smell sensitivity! It is tempting to see B_0-emergence as manifest in the action of the immune system, when the latent potential to produce appropriate antibodies is activated, but it is perhaps better understood as a highly ramified result of *A*-emergent processes. In general, in a physical context, *B*-emergence, of either type, can be taken to be compatible with the principle of causal closure.

Can emergence be symmetrical? Not on the face of it. But consider the example mentioned at the end of section 3. It is natural to think that the world of classical physics, which is 'our world', emerged from a microcosm described by quantum theory. This of course reverses the epistemological chronology. But the relevant B_0-emergent infrastructure is defined in terms that seem to anticipate and therefore require the full superstructure of yet-to-emerge classical physics.[1]

In general there is a clear distinction between *A*- and both forms of *B*-emergence. The former explores an essentially open 'space of possibilities', its products not being prefigured in any sense. In contrast the latter manifests something for which there is specific ontological support already present in the physical structure but not previously manifest. This is not necessarily meant to imply uniqueness of outcome. It is the operative potential that is unique, not necessarily its phenomenal expression. Also *B*-emergence is taken to be essentially local with the proviso that what might look local at one level of resolution could look non-local at higher resolution. We are choosing to define it so that it is local on an appropriate scale of interest. Indeed it is also possible that *B*-emergence is preceded by incremental development of constituent systems of either a behavioural or physical kind, in a manner akin to *A*-emergence. The difference would be that a

[1] Although the point is a little technical for the current context we notice that the single-particle 'path integral' is comprised of many individual paths, the characteristics of which are defined as for a classical particle and which provide the mathematical ingredients for the metaphysically more fundamental quantum representation. It is rather as if the structure of the microcosm already 'knew about', and was using, structure that could only be realized on the emergence of a conceptual distinction that did not then exist. Bohr's Principle of Complementarity (1954) has depths that we have not yet plumbed. This gives a really intriguing twist to the saga of dualism.

latent organizing or structure-creating principle did exist, dormant in the deep structure, and realized at some critical stage.

Z-emergence. The basic context assumed here is that *S* has sufficient internal structure to register the state of a complex, diverse environment *E*. The central idea is that of the emergence of new structure-creating potential. Suppose a change in the state of *S* consequent on its registering a state of *E* occasions an effect back from *S* to *E*. Suppose there has evolved in *S* a set *O* of deterministically derived responses to specific registrative states consistent with causal closure. From this basis there now emerges a new, more powerful, kind of previously latent creative potential. This is a generic potential manifest in the further emergence of a category of 'response-creators', each one spontaneously associated with, but not determined by, the registrative state in *S*. Each such response-creator selects an appropriate subset of *O* and activates its members in accordance with a structural pattern unique to it. Thus *Z*-emergence has a second-order character, amounting to a kind of meta-emergence. There are two fundamental properties:

Firstly, each instance of *Z*-emergence is manifest in the internal structure of *S* as a coordinated activation of non-local, subordinate operative processes drawn from *O* that produce convergent effects resulting in coherent output to the environment unique to the particular response-creator. Causal closure is violated at its inception by the non-random, non-deterministic actualization of a spectrum of possible options. (The registrative state individuates a multiple set of physically possible responses as described in section 2, paragraph 9.) Secondly, there is no trial-and-error phase preceding the emergence of the *Z*-operator.

By a localized registrative state here is meant one that is defined at a single specific location in *S*. A non-localized state, on the other hand, is defined at multiple, distinct locations. The reason for our emphasizing the condition of non-localization is that states in *E*, and therefore in *S*, may be built up from simpler, already established states. *E* is supposed to be too big and too complex for every possible distinct state to be correlated with a unique 'location' in the structure of *S in advance*. Of course, it is possible to suppose that a complex state might evolve a unified representation associated with a specific site-location in *S*, should it recur often enough in the interaction of *E* and *S*, and could even be an example of *A*-emergence. But we can hardly suppose that this can hold in advance for all possible such states in *E*. Such an assumption would amount to comprehensive pre-programming, or 'hard-wiring', of *S* — a kind of proto-omniscience — and this is not

realistic. It is in consideration of the creation of order-structure built up non-locally that the incompatibility with causal closure arises.

Whilst not wanting to 'over-formalize' the presentation of the argument it is useful to emphasize certain aspects in greater detail. *Z*-emergence, let it be stressed, denotes the creation of higher-order structure that cannot be accounted for in terms of existing physical 'blueprints'. As such there has to be a basic lower-order structure to provide its context. Suppose that this is established in a set

$$\boldsymbol{U} = \{O1, O2, O3, \ldots\}$$

in essence a universe of established responses to registered stimuli. $\boldsymbol{U}$ is taken to be a category of indefinite, potentially unlimited size, since new emergent responses can become 'automatic' over time. The members of $\boldsymbol{U}$ can be thought of as second-order B_0-operators meaning that they each embody a latent potentiality to excite what *have become* specific and established patterns of activity in *S* culminating in output to the environment. Suppose *S* now responds to a *novel* input registered as *NI*. *Z*-emergence is now manifest by the emergence of a composite operation $\boldsymbol{O_{NI}}$. $\boldsymbol{O_{NI}}$ consists of a newly created composite ordering of some newly selected subset of $\boldsymbol{U}$, appropriate to the emergent response to *NI*. This can be written:

$$\boldsymbol{O}_{NI} \sim \{O_{NI(1)}, O_{NI(2)}, O_{NI(3)}, \ldots, O_{NI(k)}\}$$

where the sub-operations are ordered by reference to their output to *E*. Making this explicit as a collective sequential operation whereby $O_{NI(1)}$ acts first on *E* we write:

$$\boldsymbol{O}_{NI}(E) = O_{NI(n)} \ldots O_{NI(3)} O_{NI(2)} O_{NI(1)}(E)$$

Exemplifying the *Z* response in this simple fashion is justified only by the need to illustrate the important point that the *Z*-emergent may create a time-ordered response at the output stage. In general the ordering at activation will be more complicated.

Why do we insist on defining *Z*-emergence in this way? And what has it got to do with consciousness? Basically, we are trying to identify a process that embodies a freedom to create intentional responses appropriate to, but not determined by, the registrative state *NI*. From the purely physical point of view *NI* cannot resolve the symmetry presented by the spectrum of possible responses. On purely physical grounds the response would be random. Any sustained non-randomness would imply the existence of an intrinsically different kind of activity from simple 'impact' causation. We take this as a physical

indicator, or trace, of the presence of intentional activity (see paragraph 9 of section 2).

So, in summary, *S* itself has a kind of double aspect, being both acted on and acting on its environment. *NI* is an internal registrative state that is new, that has never arisen before. It excites an operative response $\boldsymbol{O}_{NI}$ *creating* an output to the environment, there being no prior operative structure waiting to be activated. If the response were merely a form of *B*-emergence the output would carry only a quantitative relation to *NI* . So there has to be 'something' behind this, for otherwise there would be no reason for it not to be either deterministic or random. The ascription of explicit ontological status to this *Z*-emergent operative function, $\boldsymbol{O}_{NI}$, is thus logically necessary. It is reasonable then to associate this function of the registrative/creative complex (symbolized by the notational pairing of the operative aspect symbolized by $\boldsymbol{O}$ with the state *NI* that stimulates it), with a 'conscious feel'. The structural analysis of the physical process identifies a role that must be filled. But the specific nature of that analysis leaves nothing 'physical' to hang the essential nature of the objectively defined function on. And, after all, we actually know by the most immediate kind of observation what this 'something' feels like to be! It needs to be noted here that there is no question of psychokinesis in characterizing consciousness in this way. This point will be taken up in the summary.

The chosen example of *Z*-emergence is given in the next section. But it is clear that any biological system capable of supporting the formulation and enactment of the scientific paradigm must admit such an emergent structure. As has been argued the requirement of the absolute freedom to establish an experimental situation in science presupposes this capability. The crucial point, the one that necessitates the active presence of consciousness, is that, as we have stressed, the 'physics' can only resolve the symmetry created by the registrative state at random. Non-random resolution violates causal closure but is the *sine qua non* of a genuinely creative intentional function.

Basically, the argument of the paper is that if a physical substrate is to support a non-epiphenomenological world of 'meaning' it can only do so by possessing a latent potential to produce the highly symmetric states that characterize the domain of *Z*-emergence. The creation of structure by the action of a *Z*-operator, which is in principle objectively observable, then supports the claim for ascribing specific ontological status to that operator. The registrative character of that ontology is realized in the phenomenology of consciousness. There is

nothing else to do the job. It is manifest in, but not identifiable with, a purely physical process. This is the basis for the denial of physicalism.

Section 5: Application to Audition and Speech

It will be sufficient for present purposes to consider only general features of afferent acoustic processing and speech generation in the brain. Detailed references to specific brain regions will not be needed to make the point that the specific physical character of the spoken response suggests that a non-epiphenomenological account is needed. In one respect the evidence from the neuroscience is clear. Auditory input is extensively deconstructed in the brain. The first impression received by the brain respects something of the spatial properties of the source of the sounds in the close geometrical correspondence with the pattern of stimulation of the basilar membrane of the ear. In this respect there is a resemblance to the role of the retinal image in the case of visual processing. However, as the incoming information is taken deeper into the brain these similarities are wholly lost as specific properties are extracted and analysed in physically diverse locations. Although there are individual neurons that respond specifically to particular frequency intervals, that information has to be integrated with other relevant information processed at different locations. For example, a small brain area has been identified as processing the information coming from the contribution of consonants in the original acoustic input. Thus, the massive task of abstracting those physical characteristics that code for the meaning is carried out over separated spatial locations in the brain. But there seems to be no place where 'it all comes together', no single neuron, for example, the excitation of which correlates with, again for example, a specific sentence. The picture is one in which the experience of hearing and understanding a sentence is associated with a spatially and temporally distributed pattern of neuronal and synaptic activity. It is a commonplace of neuroscience that individual neurons are not in unique correspondence with elements of experiential or intentional content. Rather, an individual neuron will figure in many such correspondences. It is the synaptic patterns of multiple neuronal excitations that matter.

What is of the most acute interest in this is the nature of the dynamical activity that presages the spoken expression of intentional output. There is evidence that the memory recall of spoken words triggers activity which, beginning in the in the prefrontal cortex, then proceeds to excite the pathways in reverse order that would have been followed

had the recalled words been occasioned by actual auditory input (Roederer, 2005). The evidence is not such as to justify an exact reversal, but the brain areas are stimulated in reverse order. In this respect there is a similarity with the case of visual imagination in which a particular image is conjured in the mind's eye. A similar pattern of reversed activity is observed.

These properties are suggestive of the nature of the pattern of brain activity associated with the initiation of a speech act. The speculation, already made in the opening paragraph of this section, that non-local sites in the brain are subject to temporally coordinated stimulation at the activation of a speech intention is natural. Experientially, a conscious speech intention is pre-verbal. We do not hear with, so to speak, our mind's ear, in advance, the sentence that we shall, on the instant, speak. But there is, at least sometimes, an experiential 'something' present to consciousness prior to its actual articulation in speech. It is natural to associate the incidence of this novel state with the newly-minted appearance of a single superordinate operator presiding over the creation of the time-sequential spoken response. Again, in view of the available evidence it is natural to speculate that the pattern of excitations should follow the deconstructive path now, broadly, in reverse.

Putting it descriptively, a listener hears something said to them that they have not heard before. Its physical registration in the complex environment of their brain is spatially distributed there. Supposing their spoken reply not to be automatic, but to draw rationally on their store of knowledge, will require a precisely choreographed and exquisitely synchronized activation of many widely distributed locations in their brain. The specific response cannot be pre-programmed, for then everyone would have to know everything in advance, which is obviously unrealistic. Therefore, the response cannot arise simply by virtue of the stimulation of a single localized unit. On the contrary, the spatial distribution of the physical sites involved is unpredictable physically and is the spontaneous expression of an act of creative intentionality. This process can be characterized in the structural language we have defined as a spontaneous, emergent phenomenon in the complex neuronal environment. No purely non-intentional account could provide a rational resolution of the symmetry of the set of equally possible physical responses potentiated by the registrative state. In the context of the vast complexity of the internal brain environment, an external input establishes a registrative state precipitating the emergence of a *Z*-emergent operator that generates the particular possible response associated with the intentional act. Of course 'consciousness' cannot be directly observed, for its nature here is operative.

It is not a space-occupying entity. Rather, its objective presence is *manifest* in the non-random resolution of a situation that, from a purely physical perspective, could only yield a random pattern of activation of the set of possible responses to the physical occurrence of the brain state. Recall that it was stressed that the input was novel. The response has to have the freedom to escape the restriction that would be imposed by any requirement of pre-programming. This is the classic scenario for 'emergence', but, as we have seen, the appropriate form of this concept cannot present as a vacuum. The ontological space is filled in an abstract sense by a universal registrative/creative function that is manifest in the phenomenology of consciousness. Effectively this amounts to giving an experiential 'feel' to the activation of that operative response. It is this incidence of non-randomness that amounts to the breakdown of causal closure further to that discussed in section 2.

It is worth pointing out that the assumption of initial synchronicity does not imply that all the words end up as simultaneous utterances, hence the use of 'coordinated' above. As is well known, neuronal activity can be inhibited. This facility can be used in the generation of precisely time-ordered neuronal firing sequences as required to produce the final precise word order. Converging contributions can be 'held up' temporarily in order to contribute to the production of the final exact output sequence.

There is a need for care in the assumption of an initial, short-lived, pre-verbal state. As mentioned in paragraph 3 of this section it might seem as if this means that we need to hear in our mind's ear our spoken response before uttering it. This is emphatically not the idea. For the assertion is that of the structural comparability of the intentional and physical states with the consequence that the operative source of, at least, some speech output is non-local. If this speculation is correct, and in principle this is open to experimental test, it is significant since it suggests an ontological status for something having a definite purchase on reality that does not fit in any obvious way with established ideas. Such a test would involve observing that the resolution of certain brain states that should, on physical principles alone, yield a random distribution of outcomes in accord with an initial probability distribution, do in fact yield non-random outcomes. As such we would be presented with the extremely interesting task of experimentally testing a metaphysical prediction.

In summary, it is useful to restate the main contention of this paper, that intentional conscious acts can be correlated with multiple, synchronously organized, convergent causal processes in the brain,

resembling what from a purely physical point of view would be a time-reversed phenomenology. As pointed out in the introduction, this idea is wholly consonant with the general nature of intentionality. Could that lacuna in the physicalist's description of reality due to the operative phenomenology of consciousness be resolved in any other way?

Finally, it is worth stressing that the argument developed here has focused on the active, intentional manifestation of consciousness rather than on the problem of finding the neuronal correlates of qualia, the so-called 'hard problem'. In doing so it can be argued that insights can be gained into that problem. The theory advanced here is clearly dualistic, but does not in any way amount to a 'substance dualism'. Rather the dualism is between firstly the complementary functions of registration and interpretation of states, and secondly the creation and construction of responses. The essential but conventionally disregarded active aspect of the operative function has been brought to the centre of the theoretical stage. It has been given an abstract and objective character, a role demanded by the very nature of theoretical science, and argued here to be intimately connected to the concept of conscious mind. Evidently deeper problems loom implicit behind the issues considered here. Obviously conscious experiences do not occupy space in any sense in which that concept is conventionally understood. This will raise the immediate objection that since it has no spatially physicalized reality it can have no physical effects. Our response is to predict the physical existence of the type of situations that are described by *Z*-emergence. This suggests a re-formulation of the problem that makes McGinn (1989) despair. The source of our conceptual difficulties is the role we demand to be played by the concept of space as a universal background to all reality. But, as is becoming clear from deep problems in theoretical physics, we need to think of space as a construct rather than a pre-ordinate background. It is a mistake to think that this has implications only at the most minute physical scales.

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