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Quantum mechanics and consciousness: Thoughts on a causal correspondence theory

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Abstract Which way does causation proceed? The pattern in the material world seems to be upward: particles to molecules to organisms to brains to mental processes. In contrast, the principles of quantum mechanics allow us to see a pattern of downward causation. These new ideas describe sets of multiple levels in which each level influences the levels below it through generation and selection. Top-down causation makes exciting sense of the world: we can find analogies in psychology, in the formation of our minds, in locating the source of consciousness, and even in the possible logic of belief in God.

1. A quantum viewpoint

Over the last 100 years the study of quantum phenomena has shown that there is more than the material world of matter, force and motion. The experts have often speculated about a role for observers, even for consciousness, in an understanding of quantum measurements [1] [2]. More recently many [3] have speculated that quantum physics itself reveals consciousness. There are now many cottage industries seeking to develop ideas of 'quantum consciousness', even of 'quantum spirituality'. It has become popular to say that 'quantum theory shows that consciousness creates physical reality', and that this fits into an *advaita* non-dualist framework where only the Godhead is real while everything else is a generation of consciousness.

For many, however, such a monism where all beings are numerically identical does not seem to be the ultimate answer. People generally consider unselfish love to be superior to selfish love. If all persons were identical in being, then unselfish love between distinct persons would be impossible. The reality of unselfishness disposes many of us to dualist views in which people are ontologically distinct and in which God and worlds are distinct [4, p. 18]. It is important for theorists to explore theories in which minds and god are distinct. If mind and matter are distinct then many philosophical problems with materialism may be resolved.

I here present some ideas to help interpret quantum mechanics, mind and theism in a non-reductive approach. These ideas describe a set of multiple levels which all exist simultaneously in their own manner. Rather than everything being a system of objects at one fundamental level, we can develop a theory of multiple levels, each with different kinds of objects existing in their own kinds of spaces. The first challenge is to see how quantum substances exist on a single level. A second challenge is to show how objects interact *between* levels.

2. Substances and Multiple Levels in Quantum Mechanics

A substance is defined as what exists over the finite duration between measurement events. The problem in quantum mechanics of understanding how substances *exist* has been long-standing. Some like Everett have suggested it is the wave function which exists continuously, but wave functions are mathematical entities and not physical. Others like Bohr have said that only events are real and hence denied that there *anything* which could be a continuous substance.

My proposal is use the idea of *propensities* [5]. These are the underlying dispositions or causes which give rise to events when the conditions are appropriate. The event production may be deterministic or probabilistic. The important feature of propensities is that they are present continuously between events, at least according to the Born Law of quantum mechanics. *Propensities*, therefore, can be identified as the *substance* of which quantum particles are made. The wave function is then the *form* of those substances, in particular their form as spread out in space and time. Quantum objects are thus substances that manifest themselves in some kind of form. The form of something tells us what its present structure is, and the substance of something tells us how it would behave in all future hypothetical circumstances (even if only by probabilities).

We can develop a theory of multiple levels, each with different kinds of objects and each existing in their own kinds of spaces. We can show how objects interact *between* levels [6]. We can begin to understand this using the principles of quantum mechanics. Consider, for example, how the Schroedinger equation makes predictions for the wave function, which in turn predicts the probabilities of future events. The Schroedinger equation uses a combination of kinetic energy and potentiality that acts to evolve the wave function through time, based on the initial conditions. The wave function then acts to produce further discrete selection events based on previous selections. In each case, objects of kind of A are producing further objects of kind B_n based on previous objects B_{n-1}. The produced B_n outcomes select what kind of outcomes are next possible. Furthermore, this same pattern is repeated on multiple levels {A $\rightarrow$ B $\rightarrow$ C}. Quantum physics has the levels {energy $\rightarrow$ propensity forms $\rightarrow$ actual selections}. Such patterns are familiar, since in classical physics we have a similar structure with the levels {potential energy $\rightarrow$ forces $\rightarrow$ acceleration}. The pattern is also familiar to us from psychology in the sequence {desire $\rightarrow$ thinking $\rightarrow$ action}, as will be discussed later.

When we start digging into quantum physics, we discover even more levels. The potential energy and kinetic energy that we started with in the Schroedinger equation are not themselves fundamental, but are generated by the virtual processes of quantum field theory. Potential energy is produced by the exchange of gauge bosons: of photons of electromagnetic energy, of gluons for nuclear energy, etc. And kinetic energy comes from mass, which is mostly not 'bare mass' but is the collection of the energies of virtual substances in a cloud around a given center. This means that we have an even longer chain of multiple generative levels in quantum physics, something like {variational Lagrangian $\rightarrow$ virtual fields $\rightarrow$ virtual events $\rightarrow$ potential and kinetic energies in the Hamiltonian $\rightarrow$ propensity fields described by wave functions $\rightarrow$ selection events for actual outcomes}.

These kinds of levels are generally acknowledged to exist within quantum field theory, but with differing opinions about their significance. Many physicists and philosophers of physics want to assert the particular 'reality' of *one* of the levels and say that the prior levels are 'merely calculational devices' for the behaviour of their chosen real level. The question of simplicity, to be answered in order to apply Occam's razor, is whether it is simpler to have multiple kinds of objects existing (even within multiple generative levels) each with simple dispositions, or simpler to have fewer kinds of existing objects, but with more complicated laws governing their operation.

Allowing the multiple generative levels all to exist in 'their own way' has fruitful consequences for generalizing quantum physics to include new kinds of causation. Admittedly this is going beyond standard quantum mechanics, but at least this is yielding predictions for possible new science which can be confirmed or falsified as all science should be examined.

3. Conditional Forward Causation

From our examples, we may generalise that all the principal causation is 'down' the sequence of multiple generative levels {A $\rightarrow$ B $\rightarrow$ ... }, and that the only effect back up the sequence is the way principal causes depend on previous events or occasions to select their range of operation. Let us adopt as universal this asymmetric relationship between multiple generative levels: *that dispositions act forwards in a way conditional on certain things already existing at the later levels*. This as a simple initial hypothesis. We will see whether all dispositions seen as existing in nature can be interpreted with this pattern of *generation and selection*.

We may surmise that A, the first in the sequence, is the 'deepest underlying principle', 'source', or 'power' that is fixed through all the subsequent changes to B, C, etc. Conditional forward causation is the principle we saw from physics. It implies that changes to B, for example, come from *subsequent* operations of A, and not from C, D,.. acting in 'reverse' up the chain. We surmise, rather, that the *subsequent* operations of A are now conditioned on the results in B, C, D, etc. The operations of A are therefore the *principal causes*, whereas the dependence of those operations on the previous state of B is via *instrumental causation*, and the dependence on the results in C, D,... is via *occasional causation*. I suggest that this is a universal pattern for the operation of a class of dispositions in nature, namely those that do not follow from the rearrangement of parts of an aggregate object.

4. Generative Levels in Psychology

It is easier to understand this downward causation pattern within psychology. There are many examples of derivative dispositions in everyday life, in psychology, in particular in cognitive processes. The accomplishment of a given

disposition requires the operation of successive steps of kinds different from the overall step. The original disposition on its operation generates the "derived dispositions" for the intermediate steps, which are means to the original end. An original "disposition to learn", for example, can generate the derived "disposition to read books", which can generate further "dispositions to search for books". These dispositions can then generate dispositions to move one's body, which in turn lead to one's limbs having (physical) dispositions to move. These successively generated dispositions are all derived from the original disposition to learn, according to the specific situations.

Another example of sequential and derivative dispositions is the ability to learn. To say that someone is easy to teach, or that they are musical, for example, does not mean that there is any specific action that they are capable of doing. Rather, it means that they are disposed to learn new skills (whether of a musical or general kind), and that it is these new skills that are the dispositions that lead to specific actions.

In this I follow Broad [7]: that there are "levels" of causal influence. Particular dispositions or intentions are not the most fundamental causes, but rather "intermediate stages" in the operation of more persistent "desires" and "motivations". The intention to find a book could be the product or derivative of a more persistent "desire for reading", and need only be produced in the appropriate circumstances. Broad would say that the derived dispositions were the realization of the underlying dispositions.

The pattern of "underlying propensity / distribution / result" for "mental sub-degrees" shows the steps by which deep motivational principles (purposes) in an "interior mind" lead to action. These purposes come to fruition by means of discursive investigation of ideas, plans and alternatives in what can be called a more exterior "scientific discursive mind", as constrained by existing intellectual abilities. The actions of the sensorimotor mind select one outcome among many, as constrained by bodily conditions. Psychologists who have investigated perceptive and executive processes within the sensorimotor stage realize that these are far from simple. What we see is very much influenced by our expectations and desires, as well as by being constrained by what is in front of our eyes. There are subsidiary degrees of expectation, presentation of alternatives and resolution even during "simple" sensations.

Consciousness enters into this picture whenever actions occur. All actions of desire or love are conscious actions, and part of the conscious awareness of at least some personality or person. Consciousness is therefore not a mental source itself, but an essential aspect of operations from mental sources.

5. Mind and Physics as Levels Themselves?

I have argued that there are multiple generative levels within both the physical and mental realms. The next hypothesis is that the physical and psychological are *themselves* generative levels linked together, so that physical dispositions as a whole are derivative from mental dispositions within living and/or thinking organisms. We entertain [8] the view that the *dualism* of mind and body is

not an *ad hoc* division, but one that logically follows from the kinds of causation that exists within a universe in which there are both minds and bodies as distinct ontological substances connected as generative levels.

To see whether this works in practice, we have to consider the detailed requirements of any theory of psychology. At the simplest level of generalization, minds must be able to

- implement intended functions by feeling and thinking, then using motor areas,
- establish permanent memories, presumably by means of permanent physiological changes,
- form perceptions using information from the visual and auditory (etc.) cortexes,
- follow 'internal' trains of thought/feeling/imagining without necessarily having any external effects.

One way that these requirements can be accomplished is by means of the ideas presented so far, formulated in the following three principles:

I. Some physical/physiological potentialities (both deterministic and indeterministic according to quantum physics) are derived dispositions from minds as their principal cause. That is, minds predispose the dynamical properties of some physical objects.

II. The dispositional capacities of the mind are consequentially restricted (and hence conditioned) by their actual physical effects, by means of occasional causation.

III. The pattern of I and II is repeated for individual stages of more complex processes.

These principles together give what has been called conditional forward causation, or 'top-down causation'. Note that we do *not* have a fourth 'bottom-up' principle that neural events directly cause events to occur in the mind. We do not have general matter → mind causation, although something resembling this does arise, namely selection. This is not causation in the sense of principal causation as producing or generating the effect, but is occasional causation as being a necessary prerequisite.

A strong argument for these three principles is that they are already similar to what is known already to happen in physics. According to quantum field theory we saw how virtual events predispose the ordinary quantum wave function. These virtual events operate deterministically and describe the operation of the electric, magnetic, nuclear and gravitational forces. They are not the actual events of quantum mechanics, as those are the definite outcomes of events like observations. Rather, they are a 'prior level' of 'implicit events' whose operation is needed in order to derive or produce the potentialities for events like observations. The principle (I) states the analogical result that mental events themselves are a 'prior level' of 'implicit events' whose operation is needed in order to produce the potentialities for physical events.

The argument for the principle (II) is more general. This principle can be seen as the law according to which your future life is restricted and influenced by your past actions (by selection). Physical events are in this way the necessary foundations for permanent mental history and structure.

Principle (III) has an important corollary connected with the observations of the above section on correspondences:

IV. The mind predisposes the brain to carry out those functions which 'mirror' or 'correspond to' the mind's own functions.

Mental functions involve intermediate steps, and these intermediate mental steps predispose suitable intermediate physical steps (by I), and are in turn conditioned or confirmed by them (by II). Thus, the sequence of physical steps follows the sequence of mental steps, and the overall function of the physical process is analogous (in some sense) to the overall function of the mental process.

6. Conservation laws and closure

One purported strong indication against mind-body or mental-physical dualism is that the physical world appears to be causally closed. The total of energy and total momentum appear to be conserved whenever they have been measured in modern physics. There does not seem to be any room for minds to make a difference to evolution of the physical world. We should first note, with Meixner [9], that there is little or no experimental evidence to prove this within living bodies and especially within brains. The universal application of conservation laws is an *assumption* of the physical sciences, *not* a *result* as it is commonly presented. Arguments for causal closure have turned out to depend on some assumption that is almost identical to the result to be proved [10] [11].

Suppose that physicists found that energy and momentum were not conserved in some instances. How would they react? First, they would note that the laws apply only to *isolated* systems, so they would examine whether the object really was isolated or not, and whether they should look for something further (like a hidden planet) that was producing the effects. Secondly, they would generalize the conservation laws so the new law was satisfied but not the old one. It used to be thought, for example, that total mass and total energy were separately conserved, but, after many subatomic experiments showing the annihilation and creation of massive particles, those separate laws were quietly dropped in favor of a general law of conservation of mass-energy in combination. If, therefore, the non-conservation of energy and/or momentum were found in certain biological or psychological processes, science as we know it would not collapse. Either the influence from other kinds of beings would be ascertained, or a further generalization of the conservation laws would be sought. The only novelty in the proposals here, is that these 'other kinds of beings' would not be 'physical' in the traditional way.

7. Possible Connections to Theism

In theology, there has long been a tension between the transcendence and the immanence of God. To avoid a deism which has only transcendence, to avoid

pantheism which has only immanence, and thus to see how theism may be a coherent belief, it is necessary to give some rational account of how God may be both transcendent of and immanent in the world. One common account [12] has been to see God as the 'Author, Sustainer, and Finisher' of all natural processes. For thinkers ranging from Aquinas to Descartes "the action of divine conservation is construed to be an 'extension' of the action of divine creation", but the means of this conservation is rarely explained further. Such accounts leave uncertain the question of exactly how, in an effective as well as in an abstract sense, the Divine is immanent in nature. They do not describe the actual relationship between the immanent Divine and the causal powers determined by physical investigation.

I suggest [13] that even the Divine and creation together can be considered two generative levels, by analogy to all the other kinds of generative levels we have seen to exist within physics, within psychology, and between physics and psychology. The Divine would be the 'A', the first in the sequence, as the 'deepest underlying principle', 'source', or 'power' that is fixed through all the subsequent changes to in created beings. This is in agreement with the fundamental concept of theism, where the Divine is the source of changes, but in itself is constant in essence. This essence or underlying power would thus be the Divine Love, and could reasonably be called the Substance of the Divine. Consciousness is therefore not the divine source itself, but an essential aspect of operations from that source. More details are in [14].

The existence, powers and changes in all finite beings follow the rule that the dispositions of an object are those generated derivatives of Divine Power that accord with what is actual about those beings. Consider two analogies. God provides life as the sun shines on the earth. The sun shining on the earth is constant, but the energy received by the earth varies by days and seasons. We know, however, that this variation is according to the earth's distance and orientation: according to something actual about the earth, not because of variations in the sun. A second analogy is that God provides life as we are provided with food. Consider the way animals consume food in order to live. What an animal is capable of doing after eating depends on its digestive system and how it has assimilated the food. Different species will respond quite differently to the same food, according to how they are constituted.

8. Origin of these ideas

I have presented these ideas as worth of consideration on their own, but they really have a long history in a variety of contexts. The basic idea that causation only truly works from the mind into the brain (and not vice versa) is not a popular one today. However, it can be traced back to 'non-standard' insights of people such as Plotinus (b. 205), Boehme (b. 1575), Swedenborg (b. 1688) and some other traditions. Swedenborg was well educated as a physicist and then physiologist, so I find his accounts the most detailed and useful. Of course, he knew nothing of quantum mechanics (only Newtonian mechanics), so I have had to 're-apply' his principles in the light of what we now know about the physical world. He has the clearest presentation of the idea of 'conditional forward

causation' (he calls it 'influx into uses'), and he gives the most complete account of the 'correspondences' that exist between mental and bodily things. For a brief summary of his ideas, see [15].

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