

The International Journal for Field-Being

Causation in Field Being

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IJFB, Vol. 1(1), Part 2, Article No. 3, 2001.

Citation URL: <http://www.iifb.org/ijfb/LEWeed-2-3>

- ¶1. This paper will present an argument for an account of causation that draws on insights from John Searle, Alfred North Whitehead, and Bertrand Russell. I will argue that Causation is best understood as a Semantic aspect of *Intentionality*, which marks a process in an interconnected web of reality, which is scientifically best conceptualized as a mathematical equation, representing relations in a flux of events. Concepts, like equations, are static snapshots of a reality that is, in its nature, ever changing sets of non-substantial relations.
- ¶2. I will argue for this position, by first presenting the views of the authors that I think are on the right track in explaining causation. Then, I will select several topics from contemporary quantum physics and show how the view of reality reflected in the physics is closer to that of my select group of philosophers than it is to the views of more popular contemporary philosophers of science.

I. Causation as Process: Searle, Whitehead, and Russell

A. Causation is Intentional

- ¶3. In his book, *Intentionality*, John Searle argues that causation is an intentional, mental process that is opaque to logical deduction because it depends on an intentional content and the conditions of satisfaction of that intentional content. Searle argues against what he calls the 'regularity thesis'; a fairly common position on causation that holds that particular causal relations are instantiations of universal causal laws that exist in nature independently of anyone's thinking about them. Carl Hempel, for example, interprets causal laws as uniform and necessary universal relations in reality that are instantiated in cases such as billiard ball A hitting billiard ball B and making it move. Searle points out that Hempel's law-like account of causation, for example, is problematic because how one describes an event is highly relevant to whether one has identified a cause. Searle gives the following example to show this aspect of causation.

Since Follesdal's article on the subject (Quantification into Causal Contexts, 1971), it has been widely accepted that certain forms of causal statements are intentional. I believe that the explanation for this linguistic fact is that only certain features of events are causally relevant aspects; and therefore, since the statement claims explanatory power, truth is not preserved under substitution of other expressions that do not specify x and y under causally relevant aspects. For example, if Jones's eating the poisoned fish causally explains his death, and the event of Jones's eating the poisoned fish is identical with the event of his eating rainbow trout with sauce bearnaise for the first time in his life, it does not follow that his eating rainbow trout with sauce bearnaise for the first time in his life causally explains his death.[\[1\]](#)

- ¶4. Searle's notion of causation is derived from the experience of agency. He thinks the most primitive notion of causation is the case of someone making something happen, such as someone making her own arm go up when she raises it. Searle thinks that we, then, project this notion of agency on the world as an intentional content with satisfaction conditions, to understand how the world works. I think that Searle's account works better if the intentional content and its satisfaction conditions are thought of as projected understanding rather than as projected agency, but I have argued for that position in another paper, and will not argue for it here.[\[2\]](#) Searle's account of causation, as he presents it, below, will work as well whether we presume that *Intentionality* is projecting agency or understanding on reality. His account is:

If x causes y, then x and y stand in a relation of Intentional causation if

1. Either (a) x is an Intentional state or event and y is (or is part of) the conditions of satisfaction of x.

2. Or, (b) y is an Intentional state or event and x is (or is part of) the conditions of satisfaction of y.

3. if (a), the Intentional content of x is a causally relevant aspect under which it causes y

if (b), the Intentional content of y is a causally relevant aspect under which it is caused by x.[\[3\]](#)

- ¶5. Searle explains the convoluted set of conditionals in the above definition of "Intentional causation" by pointing out that there is a presumption of regularity in nature operating as a background assumption in his account of causation. He is presuming that the experience of perception and agency give us the intentions and satisfaction conditions that they do because the world is, to some degree, regular. To clarify how his position differs from that of philosophers like Hempel, Searle comments as follows:

Neither statements asserting the existence of the experience of causation nor the existence of instances of causation entails that there are general causal laws. Nonetheless, causal laws do exist, and a condition of the possibility of applying the notion of causation in specific cases is a general presumption of regularity in the world. Unless I presume some level of regularity-it need not be universal regularity-I cannot begin to make the distinction between its seeming to be the case that my experiences stand in causal relations as part of their conditions of satisfaction, and its really being the case that they stand in such relations.[\[4\]](#)

- ¶6. Thus, for Searle, the universe must contain some regularities for it to be something that impinges on humans in the way it does; that is, in a way that gives us experience of perception as caused by something other than our own minds, and gives us experience of our own bodies as agents that can cause themselves or other things to move or change. But this 'background assumption' is not sufficient to generate deterministic, universal causal laws. Nor does it presume that we have knowledge of the nature of any universal causal laws. The background assumption only relies on a kind of pragmatic verification. Were it not the case that our general human way of spotting deaths as caused by poisonings is somewhat accurate, more of us would die of poisoning. I will not argue for this point at present, but will pass to Whitehead's account of causation, which I think will support Searle's intentional and pragmatic view of causation.

B. Process Philosophy and Causation

- ¶7. American Pragmatists, such as Alfred North Whitehead, William James, and John Dewey, advocated a view of metaphysics that is often known as Process Philosophy because they stressed the events and processes in nature and de-emphasized the static substances and things that most of western philosophy counted as the basic 'stuff' of reality. Whitehead even suggested replacing the vocabulary with which philosophers speak of reality, substituting 'events' for 'things', 'occurrences' for 'substances', 'concrecences' and 'prehensions' for 'becomings' and 'changes' and 'evolution' or 'activity' for world inventories of things. This change in vocabulary also represents a change in focus and a change in thinking about what the world contains.
- ¶8. For Whitehead, there is nothing static or unchanging in the world. And, what humans know about the world is a very small percentage of what there is in nature. Nature consists of an uncountable number of temporary events, all of which are interconnected in infinitely many ways with all other events taking place in the universe. Events are, most centrally, activities, characterizable by verbs rather than by nouns. The activities of the world are self-driven, and reach out to other events to self-actualize through 'prehension', which is a form of teleological or goal-directed growth. Sometimes activities combine, or concrecse, forming compounds of goal-directed activities. Nature as a whole is the combined evolutionary activity of all of the individual events and interrelations within it, as they self-actualize in the world. Whitehead describes events in the following ways:

... An event is a complex fact, and the relations between two events form an almost impenetrable maze... something is always going on everywhere, even in so called empty space. This conclusion is in accord with modern physical science which presupposes the play of an electromagnetic field throughout space and time.... The important concept is that of the shifting facts of the fields of force.[\[5\]](#)

- ¶9. Even space and time are features of events, not independently existing things for Whitehead. Of space and time he says,

Whenever and where ever something is going on, there is an event. Moreover, 'whenever', and 'wherever' themselves, presuppose an event, for space and time in themselves are abstractions from events.[\[6\]](#)

- ¶10. Whitehead argues against the substantialistic materialism that is more common in western philosophy by ridiculing it in this way.

The materialistic theory has all the completeness of the thought of the middle ages, which had a complete answer to everything, be it in heaven or in hell or in nature. There is a trimness about it, with its instantaneous present, its vanished past, its non-existent future, and its inert matter. This trimness is very medieval and ill-accords with brute fact.[\[7\]](#)

- ¶11. So, for Whitehead, and Process philosophers who follow him, the static materialism that comes from either the notion that reality is eternal 'forms' or 'ideas' of a Platonic kind, or that reality is mid-sized substances of an Aristotelian sort is flatly rejected. Instead, reality must be understood as a collection of interrelationships among activities.

- ¶12. Whitehead also rejects the notion of causation that depends on an instantaneous present, a vanished past, a non-existent future, and inert matter. Hobbesian[\[8\]](#) mechanism, or the mechanical view of reality that psychologists like B.F. Skinner[\[9\]](#) or philosophers like J.L.Mackie[\[10\]](#) or Hector-Neri Castaneda[\[11\]](#) depend on is also incompatible with brute fact, as represented in relativity theory according to Whitehead. He argues against a mechanistic view of the interrelations among static substances as follows:

The false idea that we have to get rid of (to understand relativity theory) is that of nature as a mere aggregate of independent entities, each capable of isolation. According to this conception, these entities, whose characters are capable of isolated definition come together, and by their accidental relations form the system of nature. This system is thus, thoroughly accidental; and even if it be subject to a mechanical fate, it is only accidentally so subject. [\[12\]](#)

- ¶13. Whitehead's main objection to the mechanical view of change is that it pre-supposes a static view of time and space, as being something like a Laplace coordinate system within which change takes place. But relativity theory indicates that there is no such rigid grid to form the pool-table-like frame for a billiard-balls like view of mechanism. What reality offers instead, according to Whitehead, is an infinite variety of potential time-space grids, any one of which would suffice to describe some universe, namely, the universe of which that time-space grid is a feature of the events. Whitehead says that within a mechanistic view of reality,

...We think of one necessary time system and necessary space. According to the new theory, there are an indefinite number of discordant time series and an indefinite number of distinct spaces. Any co-related pair, a time-system and a space-system, will do in which to fit our description of the universe.[\[13\]](#)

- ¶14. Whitehead claims that a view of reality that supposed the autonomy of entities and the autonomy of space and time, must ask the wrong questions about how particles of reality interact with one another. Having initially misunderstood the particles as inert points, and the space and time in which they move as a static frame, a proponent of mechanism is, then, bound to misunderstand the interaction among these entities. Questions of how entities 'carry' causation are asked by Castaneda, and questions about the 'motile' properties of objects are asked by Mackie. Whitehead argues that these are the wrong kinds of questions to ask.

We have to ask ourselves what are the Laws of Nature which led the material particle to adopt just this path among event particles and no other... We have got to find the way of expressing the field of activity of events in the neighborhood of some definite event-particle E of the four-dimensional manifold. I bring in a fundamental physical idea which I call the 'impetus' to express this physical field. The event-particle E is related to any neighboring event-particle P by an element of impetus. The assemblage of all of the elements of impetus relating E to the assemblage of event particles in the neighborhood of E expresses the character of the field of activity in the neighborhood of E.[\[14\]](#)

- ¶15. If mechanism is to be found at all in Whitehead's interactive and complex view of causation as impetus, it is a far more complex notion than would be found in a materialistic view. And there are several reasons for saying that Whitehead's view of causation is not mechanistic at all. In *Process and Reality*, Whitehead calls these acts of impetus prehensions, and attributes a goal-oriented quality and self-realization to them. That in itself would give acts of impetus an intentional quality and a focus as performed by agents, even if the agents are only minimalist event-particle agents.
- ¶16. But there is also another element of intentionality in the impetus of events as characterized by Whitehead. Which space-system and time-system one picks to frame one's inquiry, and which event-particles one picks to explain will all be colored by the intentionality of description, as described by Searle, and the intentionality of the point of view of an observer, in a more general sense. In Whitehead's view of reality, there is no necessary or default point of view or frame of reference which can, like a Hobbesian pool table, determine how the multi-dimensional events ought to be divided into distinct event particles. So the questions asked by a would-be knower are also, in Whitehead's view, irreducibly intentional. To summarize what I take myself to have argued for thus far in this paper;

1. Causation is Intentional,

- a) in Searle's sense, as projected agency,**
- b) as Searle pointed out, as being dependent on descriptions of events,**
- c) also, as relative to point of view of observer**
- d) and as determinative of the things to be understood.**

2. Causation must be understood within the context of a process reality,

- a) consisting of event-particles**
- b) characterized by activity and self-actualization**
- c) and known through intentional selection of both event-particles and frames of reference.**

- ¶17. I will now analyze the view of causation developed so far in this paper from the point of view of a mathematical or quantum physics view of causation.

C. Mathematics and Causation

- ¶18. Bertrand Russell claimed that causation was a mathematical equation. Of the notion of causation espoused by philosophers like Mill, Hobbes, and by extension, Mackie and Castaneda, Russell says:

The Law of Causality, I believe, like much that passes muster among philosophers, is a relic of a bygone age, surviving, like the monarchy only because it is erroneously supposed to do no harm. [\[15\]](#)

- ¶19. Russell argues that the notion of causation as traditionally presented is indeed harmful, because it so badly misrepresents the reality that it purports to explain. Russell points out that the Law of Gravity, for instance, does not specify a classical cause-effect relationship. What it does offer is a statement of a relationship that is an empirical generalization. Most specifically, the relationship in question in the Law of Gravity is stated as a formula, which is also expressible as a differential equation. [\[16\]](#) This relationship is not apriori, or a presupposition of science, does not reflect the existence of any universal laws, not even itself, makes no distinction between past and future and is not empirically verifiable in any way that would please the Vienna Circle.

- ¶20. Russell's view of causation is much closer to the view presented in contemporary quantum physics than that of many contemporary philosophers. Richard Taylor, C.J. Ducasse and Roderick Chisholm [\[17\]](#) offer views of causation that ill accord with physics, as well as Mackie and Castaneda. Taylor's and Ducasse's views accord better with the common sense or colloquial uses of the word 'cause', than any of the other views. But if Russell and the physicists are right, the colloquial use of the word may well have nothing at all to do with the operation of metaphysical reality.

- ¶21. In a discussion of Einstein's view of science, Edward MacKinnon points out that Russell's mathematical perspective is also central in Einstein's thinking:

In spite of the mathematical complexity proper to tensor calculus, what is under consideration is a theory of matter in which differential equations are basic. Differential equations presuppose continuity, e.g. continuous fields of force. In this approach, accordingly, continuity is already present as an implicit presupposition of the methodology used. The hope is to explain atomicity as something derivative. In these later theories, the electron is not thought of as a singularity in a field, as in the earlier, unsuccessful electrodynamics, but as a locus of balancing force fields. This stress on continua as basic characterized Einstein's subsequent theorizing. [\[18\]](#)

- ¶22. So, contemporary physics is, as Russell said, mathematically conceptualized, and conceptualized as equations describing balanced force fields.

Summary, Section I

- ¶23. So, to the points that I have already cited in Searle and Whitehead, my scavenging of principles from Russell will add:

Causation is a mutual interrelationship

- a. Between sides of an equation, described in mathematical terms
- b. Reconciling necessity and contingency
- c. Selecting and defining a frame of reference or a context for understanding
- d. Placing a static 'snap-shot' like frame for understanding over a fluid and ever-changing four-dimensional continuum of activity
- e. Describing balanced Fields of Force.

- ¶24. I will argue in the second section of this paper that these features of causation more accurately reflect the contemporary view of reality in quantum physics than Mackie's view, or that of some of the other philosophers I've been discussing.

II Causation in Contemporary Quantum Physics

- ¶25. I will very briefly summarize some of the features of quantum physics that support the views of Russell, Searle and Whitehead that I have summarized in the first section of this paper, at the expense of the others that I discussed. I will do this topically, picking up threads of the position that I am assembling as I go along.

A. Indeterminism

- ¶26. Deterministic and mechanical causal relations are a significant feature of causation as it is understood by both classical physics and modern philosophy. Physics at the end of the twentieth century, however, denies that the universe is a deterministic mechanical system. Even classical two-sorted logic is questioned here. Abner Shimony argues:

According to Classical Physics, the specification of the state of a system determines the truth or falsity of each of its eventualities.... By contrast, quantum mechanics holds that a maximal specification of a system-its state-does not assign a definite truth or falsity to each of its eventualities. When any state of the system is given, there exist eventualities which do not have a definite truth or falsity, not because of ignorance on the part of some or all human beings, but because they are objectively indefinite.[\[19\]](#)

- ¶27. Shimony proceeds to argue that some element of what he calls 'objective chance' follows from the objective indefiniteness of physical systems. Shimony elaborates on the consequences of indefiniteness and chance by saying that systems must be understood as networks of interaction among many indefinite eventualities that can be understood as interacting to actualize potentialities. These actualized potentialities, however, have more in common with Richard Feynman's diagrammatic and probabilistic 'sums over histories'[\[20\]](#) than they have in common with Aristotelian or Aquinian actualization of potentials.
- ¶28. The notions of necessary connection, apriori knowability, and a direct object-to-object relationship, are clearly gone from the Shimony view of quantum mechanics. What remains is the idea that relationships of a wide diversity of networking types take place among various aspects of the physical world, and that determinism does not govern these relations. Mathematical equations can describe the relations in question, and they do so in a way that is, as Russell said, temporally insensitive, and as Whitehead said, based on an intentional selection of time and space framework.

- ¶29. Paul Davies also argues that the indeterminacy principle indicates that Whitehead is closer to the truth about the processes in reality than many substantialist philosophers. Davies explicitly argues for a Whiteheadian view of the relationship between contingency and necessity in the concept of God. Davies argues that the indeterminacy principle makes the following view of the universe the most probably true.

Let us now return to the Theological Analogue. This mixture of contingency and necessity corresponds to a God who necessarily determines what alternative worlds are available to nature, but who leaves open the freedom of nature to choose from among the alternatives. In process theology the assumption is made that the alternatives are necessarily fixed in order to achieve a valued end result, i.e. they direct or encourage the (otherwise unconstrained) universe to evolve towards something good. Yet, within this directed framework there remains openness. The world is, therefore, neither wholly determined nor arbitrary, but like Wheeler's cloud, an intimate amalgam of chance and choice.[\[21\]](#)

- ¶30. Hobbes or Skinner would obviously be unlikely to accept the freedom in nature that Shimony and Davies claim is the factual result of quantum physics. The notion of time and relativity in the most recent physics also ill accords with the position of many philosophers who write on causation. I will now turn my attention to that topic.

B. Relativity and Time

- ¶31. Stephen Hawking points out that once time is listed as another dimension, along with the three spatial dimensions in an equation, it becomes theoretically irrelevant whether time will run forward or backward. The notion of four-dimensional space is intimately tied to the notion of whether the universe as a whole is contracting or expanding. If we had a contracting rather than expanding universe, the Law of Entropy might run in reverse, rather than as it does, and things might tend to move from less to more organization. All Laws of Physics except the law of entropy would remain constant under such a 'reversal of the order of time.'[\[22\]](#)

- ¶32. The principle of relativity pointed out that the only constant in physics is the speed of light. All other laws of nature, relations in nature and qualities of things are observer-relative in at least two important respects. First, all properties of objects vary according to the position, momentum, and direction of the observer. From this observation it follows that no Laplace-like space-time grid exists that can be used as a background against which all other movements can be said to take place. If everything moves with respect to everything else, any place or time can be selected to be the position of the observer, and any other place or time can be the event observed, and for any such pair, what is observed will vary. This observation reinforces Whitehead's claim that any pair of space and time coordinates can be selected to determine a space-time grid for locating event-particles.
- ¶33. Secondly, for any such pair, the act of observation by the observer alters the state of the event observed. The Enlightenment ideal of objectivity and the Vienna Circle's ideal of verification both seem to crash on these considerations. But Searle's notion that conditions of satisfaction and intentions are systematically co-related in the observation of a cause is supported by this view of the relationship between causation and observation. Whitehead's view that every event is part of every other event, and all interact with one another, and are affected by one another's actions, also appears to be reinforced by Hawking's claim. In addition, Whitehead's notion of events as self-actualizations seems better to comply with the following observations from quantum mechanics.

C. Self-Actualizing Event Particles

- ¶34. Some of the basic concepts in Newtonian Physics were the equilibrium principles. Classical Physics presumed that entropy governs all physical interactions, and that in addition to seeking disorder, physical systems also seek the lowest state of kinetic energy possible. So, chemical phenomena seek a "detailed balance," high-energy systems lose energy, organized structures disintegrate, etc. Generally speaking, energy must be introduced to a system to reverse the entropic tendency and bring about order. But quantum mechanics has discovered that there are systems in which something quite different happens. Gregoire Nicolis explains,

Such ordinary systems as a layer of fluid or a mixture of chemical products can generate, under appropriate conditions, a multitude of self-organizing phenomena on a macroscopic scale - a scale orders of magnitude larger than the range of fundamental interactions- in the form of spatial patterns or temporal rhythms. ... Non-linear dynamics and the presence of constraints maintaining the system far from equilibrium will turn out to be the basic mechanisms involved in the emergence of these phenomena. [\[23\]](#)

- ¶35. Nicholis points out that convection in thermodynamics, the formation of chemical turbulence and wave fronts in vats of chemicals, oceans or weather systems, and chemotaxis and morphogenesis in biological systems, as well as statistically modeled behaviors of human populations, all exhibit certain properties in common. What is happening when these processes take place is something other than equilibrium-which is a universal or default attractor for systems-is acting as an attractor. So, symmetry is broken, and the system must make an historical 'choice' among attractors, resulting in a bifurcation of histories for the system. A system undergoes radical change when a critical threshold is crossed, breaking symmetry and resulting in a phase transition. The crossing of the critical threshold forces the system to make a choice which is governed by chaos theory and occurs according to fractal geometry. The way the choice falls will subsequently mark the system as left or right handed, and will become self-generating of the organization that has been initiated by the choice. Nicholis explains the generation of self-organization this way:

Now, a very characteristic feature of the vast majority of systems encountered in nature is that the Fs [fluxes] are complicated nonlinear functions of Xs [instantaneous states]. In a fluid in motion, this has to do with the fact that the transport of its properties, like, for instance, energy, is carried out by the motion itself, whose velocity is one of the variables to be determined. [by an equation measuring evolution]. In chemical reactions or in biology it has to do with the ability of certain kinds of molecules to perform autocatalytic and other regulatory functions. And, in an animal or human populations, nonlinearity may reflect the processes of communication, competition, growth or information exchange. In short, the equations of evolution of all these systems should admit under certain conditions several solutions, since by definition, multiplicity of solutions is the most typical feature of a nonlinear equation.[\[24\]](#)

- ¶36. So, Nicholis would seem to be articulating the mechanics of Whitehead's claim that event-particles can make a choice of attractors towards which to develop. Whitehead's notion that activities set priorities and appropriate directions of activity also seems at home in Nicholis' description of phase transitions and symmetry breaking. Also, there is a degree of randomness in the way that these choices are made, and real options exist for the direction in which the choice will lead the system to develop. Obviously, whether the choice is random or creative will be relevant at the conscious level of organization, and either irrelevant or 'creative' in some very minimalist sense at lower levels of organization. What is more important to observe here is that the choice in question goes in a specific direction; it exhibits the behavior that Whitehead called prehension, and it becomes self-generating of a new form of order initiated by the choice. I think that these two points are sufficient to characterize the change as resembling Whitehead's impetus, more than the mechanical notions of a

cause that I've been arguing against in this paper.

- ¶37. One more statement from Nicholis will further clarify the interrelatedness and networked nature of nature according to quantum mechanics.

In short, we arrive at a simple, appealing picture of how order can emerge in a system. In somewhat anthropomorphic terms, order appears to be a compromise between two antagonists: the nonlinear chemical-like process, which, through fluctuations sends continuously but incoherently, 'innovating signals' to the system and the transport-like process which captures, relays and stabilizes them. Disturbing the delicate balance between these two 'actors' leads to such qualitative changes as an erratic state in which each element of the system acts on its own, or, on the contrary, a 'homeostatic' fossil-like state in which fluctuations are crushed and a full uniformity is imposed. Complexity and Self-organization appear, therefore, to be limited on both sides by two different kinds of states of disorder[25]

- ¶38. The balancing of opposites in a networked interrelationship of principles in this passage is clearly reminiscent of Whitehead's view of dynamic give and take in reality. Gravitational forces were the 'odd', difficult to understand forces of modern science, when a billiard-balls paradigm of movement dominated thinking about how change occurs. But in the broader view of quantum physics, mutual interrelations and effects are proving to be paradigmatic, and pushes and shoves to be the marginal types of movement-invokers.
- ¶39. Nicholis speaks very little of objects, although his stabilizing force might generate fossilization. But the stress in this passage is clearly on interrelations among interrelated processes. Nature is a dynamic, interreactive and, to some degree, self-generating organism, to a far greater extent than it is a static collection of objects suffering from inertia, and transferring 'motility' from one to another.

D. Complementarity

- ¶40. Quantum physics also exhibits interrelationships of another kind that would be impossible to understand using classical mechanics. Complementarity or Synchronicity relationships are best exemplified in Bell's thought experiments that were designed to test an argument for scientific realism written by Einstein, Podolsky and Rosen. The EPR argument claimed that the principles of quantum mechanics, when applied to a two particle thought experiment, led to paradoxical results. The experimenter could achieve precise knowledge of both the net momentum and relative position of both particles in the system. From this it followed that either quantum physics was an incomplete system, or some form of action at a distance was taking place. As realists, the authors of the EPR paper insisted that some underlying, but unknown, reality must correspond to the computable values of the physical quantities in the thought experiment. So, the EPR authors concluded that quantum physics must be incomplete.[\[26\]](#)
- ¶41. Bell's thought experiment was tested in 1972 by S. Freedman and J.C. Clauser, and further in 1982 by Aspect, Dalibard and Roger. These experiments confirmed Bell's conjectures, mathematically showing some very odd synchronicities between the two particles in the thought experiment, and seeming to indicate that there was something wrong with the eminently reasonable argument in the EPR paper[\[27\]](#)
- ¶42. Even before the Bell-type experiments, Neils Bohr had been arguing against Einstein, that quantum mechanics had to be understood in an epistemological, somewhat Kantian way, rather than as a realistic description of a noumenal world. Bohr had argued that the observing mind disturbs the observation, and so, no observer-independent claims can be made about the world based on quantum physics. Einstein argued for a more realistic interpretation of what physics shows. But the Bell-type experiment seems to have tilted the scales of evidence against the realistic assumptions of EPR and in the direction of Bohr's notion of a complementarity between knowing minds and what is known.
- ¶43. Abner Shimony argues that the Bell-type experiments leave only two options for understanding what is happening when the apparently independent particles are exhibiting synchronous behavior. Shimony says the first option is to agree with Bohr, who he quotes as saying:

There is no quantum world. There is only an abstract quantum description. It is wrong to think that the task of physics is to find out how nature is. Physics concerns what we can say about nature.[\[28\]](#)

- ¶44. Shimony rejects the Bohr option because he considers it too anthropomorphic to accept, and he does not think that physics can really claim to be able to do its work without "characterizing the intrinsic states of physical systems."[\[29\]](#)
- ¶45. The other option that Shimony considers is to accept the notion of action at a distance. Shimony points out that the two-particle system can be seen as having a web-like relationship involving the two photons, and the actualities and potentialities of both of them, rather than as being independent entities. If this position is taken, the photons would form a Whiteheadian network of events in contrast with a metaphysics of individuals of the type that Strawson advocated.[\[30\]](#)
- ¶46. Shimony also points out that this change in metaphysics would have wide-ranging repercussions, as follows:

We should like to know what implications quantum non-separability has for the geometrical structure of space-time. If there is a genuine causal relation between two events with space-like separation, then our present conception of space-time structure must be changed, because in both special and general relativity theory such causal relations are excluded.[\[31\]](#)

- ¶47. However, if space and time are seen as functions of events rather than events being seen as individuals occurring in a space-time locus, the problem does not seem so intractable. Whitehead would seem to have a more appropriate notion of how physical reality works, in this respect, than realist philosophers like Strawson do.

Conclusion

- ¶48. In this paper I have argued for a view of causation that is Intentional and interrelated with the interests of knowers, as John Searle claimed, and understood mainly as a reciprocal relationship which is, in mathematical terms, a linear or non-linear equation, as Russell argued. Further, causation must be a networking relationship among ever-changing processes, that exhibits self-directed activity and complementarity. No causal process exists context-free or in a static place or time. A thinker may select a static snapshot-like view of reality to analyze, but in so doing, the thinker, necessarily, imposes some distortion on the very un-snapshot-like imbedded and moving activity that one is trying to understand. I have argued that Whitehead gives more insight into this view of causal relations than more realistically-motivated philosophers, such as Mackie, Strawson, Chisholm, and Castaneda.

END NOTES

1. John Searle, *Intentionality*, New York: Cambridge University Press (1983), 117.
2. Laura Weed, *The Structure of Thinking*, Thorverton, UK: Academic Imprints UK (2002).
3. John Searle, *Intentionality*, New York: Cambridge University Press (1983), 122-123.
4. *ibid.*, 134-135.
5. Alfred N. Whitehead, *The Concept of Nature*, London: Cambridge University Press (1926), 78.
6. *ibid.*, 78.
7. *ibid.*, 73.
8. In *Leviathan*, Thomas Hobbes argues for a mechanical view of reality in which 'desires' and 'adversions' account for all of the movement in reality.
9. In B F. Skinner, *Science and Human Behavior*, New York: Macmillan (1953), Skinner argues for complete determinism in human behavior.
10. In Mackie, *The Cement of the Universe*, Oxford: Oxford Press (1974), Mackie argues that causation is a transfer of force between objects.
11. In Castaneda, *Causes, Causity and Energy*, *Midwest Studies in Philosophy*, 9 1984, 17-27, Castaneda argues that 'causity' is a mysterious thing that jumps from object to object.
12. Alfred N. Whitehead, *The Concept of Nature*, London: Cambridge University Press (1926), 141.
13. *ibid.*, 178.
14. *ibid.*, 181.

- [15.](#) Bertrand Russell, [On the Notion of a Cause](#) in A. Schoedinger (Ed.), *Introduction to Metaphysics* Buffalo, NY: Prometheus Books (1991), 119.
- [16.](#) *ibid.*, 126.
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- [27.](#) Many Thanks to Bill Hagan of the Chemistry Department at The College of St. Rose for helpful comments and revised language in this section of the paper, and for valuable feedback on the whole paper.
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ISSN 1548-6001

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