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Values and the Quantum Conception of Man *

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Abstract

Classical mechanics is based upon a mechanical picture of nature that is fundamentally incorrect. It has been replaced at the basic level by a radically different theory: quantum mechanics. This change entails an enormous shift in our basic conception of nature, one that can profoundly alter the scientific image of man himself. Self-image is the foundation of values, and the replacement of the mechanistic self-image derived from classical mechanics by one concordant with quantum mechanics may provide the foundation of a moral order better suited to our times, a self-image that endows human life with meaning, responsibility, and a deeper linkage to nature as a whole.

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Disclaimer

1. Introduction

Science has enriched our lives in many ways. It has lightened the burden of dreary tasks and enhanced our creative capacities. It has conquered diseases and extended our productive years. It has broadened our understanding of the universe about us and our place within it. Yet, while conferring these benefits, it has created the problems of crowding, pollution, alienation, and even the threat of self-extinction. To resolve these problems a moral base is needed. However, science has also largely destroyed, at least among the educated, the traditional foundation of morality, namely ancient beliefs about our link to the power that created both ourselves and the world about us. In particular, classical mechanics, which for centuries was our basic science, transformed the impulse that forms and sustains the world into a primordial burst of energy that set the universe in motion, but then lapsed into total passivity. Each man became, in this classical conception, a mechanical and microscopically controlled automata whose every action was preordained before he was born. Gone, or diminished, is the idea that we bear responsibility for our actions, for we were taught by science to see ourselves not as agents of a creative power, free to choose from among options, but rather as mechanical devices running on automatic, ruled by forces beyond our control. Science, having thus undermined the traditional foundation of morality, seemed to offer no adequate replacement.

In its original seventeenth-century form classical mechanics did not wholly eliminate the capacity of spirit and mind to influence the course of human actions. Thoughts were allowed to interact with brains and, through them, to affect the motions of our bodies. But by the beginning of the present century both thoughts and gods alike had, according to science, been rendered impotent: they could do no more than passively observe the mechanically generated course of physical events. The clarity and consistency of this conception of the universe seemed so perfect, and the power of the idea to produce both beguiling new products and stable nations seemed so strong, that its survival seemed assured. Yet these concepts are fundamentally incorrect. They are unable to account for the detailed behavior of various materials, and by the 1930's this mechanical conception of nature had been replaced at the fundamental level by something profoundly different: quantum mechanics.

The enormous conceptual gulf between quantum mechanics and classical mechanics has blocked the dissemination of this radically new conception of man and nature into the intellectual community at large. Hence its impact upon moral philosophy has been virtually nil. Yet one can scarcely imagine that the world view that had served as the ideological basis of the industrial and early scientific age can become so thoroughly repudiated without its explosive impact on our conception of ourselves eventually asserting itself. Indeed, the greatest remaining gift of science to man may be not a still greater mastery of our physical environment, but rather an unraveling of the mystery of our own beingness, and the consequent rise of a rational system of values based on a more valid self image.

In this contribution to the symposium I shall describe what appears to me to be the impact upon moral issues of the quantum revolution in science. Because these questions appeared to have no immediate professional relevance to scientists, the issues have not yet been widely discussed by those best equipt to understand them. I shall therefore endeavour to describe the situation in a way that will be clear to nonscientists, who will need to see beyond the technicalities, and also to physicist, who will want to see, in some form, the technical basis.

2. From Atom to Man

Quantum mechanics was originally a theory about atoms and their constituents: it was about our observations on systems composed of electrons, photons, and atomic nucleii. However, these are the same elements from which most materials are made, including the tissues and other components of our brains and bodies. Consequently, quantum mechanics is not merely a theory about atoms: it is our fundamental physical theory about the detailed behavior of all material things, including our own bodies and brains. Yet the relationship of quantum mechanics to man goes far beyond the fact that our bodies and brains are composed of atoms. In order to construct a rationally coherent theory of atomic phenomena Niels Bohr found it necessary to bring human observers into the theory: classically describable perceptions of human observers became the basic realities of the theory, and the mathematical formalism was construed not as the description of the actual form or structure of an externally existing reality, but rather as a scheme that scientist and engineers could use to make predictions about the structure of their experiences pertaining to a world that was given no definite actual form independently of our experience of it. This radical move was fiercely opposed by Einstein, and many other eminent physicists of that time. But they could come up with no satisfactory alternative.

The issue was subsequently re-opened, and logically acceptable alternatives to the Bohr interpretation are now available. But the fact remains that any theory that fits the empirical facts must accept as elements either perceptions of human obervers, or other elements that, like human perceptions, link together sequences of classically describable states as *alternative* possibilities, even though the basic quantum mechanical law of motion, the Schroedinger equation, generates no such *either-or* decomposition.

There is no empirical evidence supporting the notion that there is anything other than consciousness, or mind, that makes this separation into *alternative* possibilities, and chooses between them. Moreover, if something else is brought in to do the job, then it is a 'stand in' for consciousness, in the sense that consciousness is all that is needed; and if something else plays this role, then a mystery is generated: Why does consciousness exist at all? For if mind does not effect the choices that are needed to complete the quantum theoretical conception of nature, then thoughts appear to have no function at all in nature: they become superfluous.

Bohr adopted a very parsimonious position: he brought in only the minimum structure needed to fit the empirical facts. He introduced no extra physical paraphernalia to define the alternatives and choose between them. He let our perceptions themselves specify what has happened. The introduction of our perceptions of the physical world into the basic physical theory, though considered unorthodox during the twenties, can hardly be deemed irrational. For scientists rarely deny the existence of our perceptions of the world. Bohr merely introduced into our basic scientific theory something already known to exist, and, in fact, the very thing whose existence is most certain to us, and whose structure is precisely thing that our science needs in the end to explain.

Yet Bohr's move seemed retrograde at the time. For the tremendous success of science was widely perceived to be a vindication of the wisdom of excluding spirit and mind from our scientific conception of the physical world, along with religious dogmas and myths.

Bohr proceeded very cautiously with the re-introduction of mind into science. Keeping the connection to the actual practices of physicists in the fore, he and his colleagues, principally Heisenberg, Pauli, and Born, formulated quantum theory as a set of rules that allowed scientists to calculate the probabilities that perceptions conforming to classically describable specifications would occur under classically describable conditions.

Complications pertaining to the living tissues in the bodies and brains of the human observers were kept out of the theory by focussing on the classically describable specifications themselves, without worrying about how we know whether or not these conditions are actually met in real cases. However, the pragmatic approach rests squarely upon our being able to decide, in practice, whether such specifications are met or not.

Bohr could not evade this reference to our perceptions by postulating the existence of some other classical level of beingness. For to admit the existence of some other level of reality would contradict his basic claim, which was that quantum theory, in the form he proposed, was complete. Admitting the existence of a classical level of physical reality would require a whole new level of theoretical machinery. This he avoided by allowing our perceptions, already known to exist, to be the things that were the subject of his classically describable specifications.

Although this pragmatic Copenhagen approach was efficient and practical in the domain of atomic physics, it provided no detailed idea of how nature managed to make the quantum rules work. This lacuna was of no great concern to practical-minded atomic scientists, but it hindered efforts to extend the scope of the theory to other domains, such as cosmology and biology. Heisenberg, von Neumann, and others improved the theory in this respect by providing a theory for how nature could work in a way that would make the empirically validated rules come out true.

The key element of this ontology was the concept of 'events'. Although there were differences among various authors regarding fine points, the simplest formulation of the idea is that the probability wave of the earlier pragmatic interpretation, which evolves in accordance with a fixed deterministic equation of motion, the Schroedinger equation, is elevated in status from a subjective entity that scientists use to compute probabilities pertaining to their classically describable perceptions of the world, to an objective property of nature herself. This objective property is tied to the idea of 'events': the probability wave is considered to define an *objective tendency* for an *actual event* to occur. The occurrence of any such actual event will reduce some of the uncertainties that had existed in nature prior to the occurrence of this event, and this reduction in these uncertainties will be reflected in *a new set* of objective tendencies for the next event, and hence a sudden change in the probability wave. The fact that the probability wave specifies only 'objective tendencies' for the next event, not definite certainties, means that the particular event that will occur next is not uniquely determined beforehand: the choice from among the allowed possibilities is a random event, with the statistical weights of the various possibilities being specified by the probability wave.

This model of nature can be set up so as to retreat again from the idea of bringing mind into physical theory. That was Heisenberg's tack. But this brings up the same problem as before: it leaves mind with nothing to do. However, there is no rational reason to exclude from physical theory something that we know exists, and that seems to do something, and then to bring in, instead, something else, unknown to us, to do exactly what the known thing seems to do, merely because in an earlier *and now deposed* theory the known thing could not do what it seemed to do, namely make real choices between open and available possibilities.

Von Neumann brought the brains of the observers explicitly into the description of nature, and stressed the possibility of identifying the 'choosing events', needed by quantum theory, with those brain events that can be considered to be representations, within quantum mechanically described brains, of mental events. This approach constitutes, essentially, an ontological version of the Bohr approach, in that the mental events, which are what specifies what actually happens, are tied directly to the quantum formalism without the explicit introduction of any intermediate classical level of reality.

This von Neumann approach is not the only ontological possibility. But it can, I believe, be rightfully regarded as the most orthodox of the quantum ontologies, for two reasons. The first is that it is the ontology closest in spirit to Bohr's approach: no extra classical level intervenes between the quantum level of description and the classically describable perceptions, and no profusion of extra unobserved worlds is brought in. The idea that one should introduce into physics unverifiable classical levels of physical reality is exactly the idea that Bohr fought so strongly against. The second reason is that when the other quantum ontologies are considered, their predictions are considered unorthodox to the extent that the extra structure they introduce produces a deviation from the predictions obtained without introducing the extra structure. This von Neumann ontology is the one that leaves out all the excess structure.

I attribute this ontolgy to von Neumann because his close friend and colleague Eugene Wigner did so in a later work, in which he extols and further describes it. Von Neumann (1932) describes this ontology briefly, but his definite preference for it is not clearly spelled out in his own work. Perhaps this approach would be better called the von Neumann-Wigner ontology, but Wigner later rejected it, for reasons I deem insufficient.

Yet what has all this discussion about man and nature to do with values? The answer lies in the central importance to moral philosophy of our beliefs about such things.

3. The Importance of Beliefs

If a person truly believes that doing some act will cause him to suffer the flames of eternal damnation, then he will probably be disinclined to do it. If he has no such belief, but believes himself to be a rotten worthless being who acts only to benefit himself, regardless of the consequences to others, then he will probably act in this way and thereby become what he believes himself to be. If, on the other hand, he believes himself to be made of finer stuff, and the product of a worthy lineage of high-minded souls, then he may be inclined to measure up to lofty ideals, and thereby to extend the lineage. What one believes about himself, and his connection to the rest of the universe, exerts a powerful influence on one's behaviour, and it is the whole basis for rational action.

Science is a principal source of rationally held beliefs. If one believes himself to be a mechanically generated product of his genetic make-up and a mechanically pre-determined physical environment then he probably will be far less able to release his full creative energy than if he believe himself to be a facet of a universal impulse in nature that exploits the indeterminateness of the physical world to actualize intentions and generate meaning. Moreover, from a rationally based perception of a deep-seated wholeness of nature there can flow both more compassion and less alienation.

4. The Nature of Man.

What is the quantum mechanical conception of the nature of man?

By the quantum mechanical conception I shall mean, for the reasons given above, the von Neumann conception. I have in my book and elsewhere (Stapp, 1993, 1995a-c) filled in some of the details of this conception in a way that seems both natural and compatible with the empirical evidence from neuroscience and psychology. The key point is that each human conscious event is represented in this conception of nature by a quantum event that actualizes *an extended structure* in the brain of some human being. This event selects, and brings into being, one template for action from among many that, according to the quantum mechanical laws, were all physically possible just prior to that event. Each such template is a coordinated plan of action for this brain and the body it controls.

In any physical theory of man a primary job of man's brain must be to form such templates for action. The essential difference between the classical and quantum conceptions is that in the classical conception the brain must come up—quickly in an emergency situation—with exactly *one* template for action, which will direct the unfolding of some coherent action, whereas in the quantum case, because of Heisenberg's indeterminacy principle, the evolution in accordance with the Schroedinger equation will generate a host of alternative possible templates for action. Thus if a situation calling for action presents itself to an alert person, his brain will generate *one* template for action, according to the classical conception of nature, but many alternative possible templates for action according to the quantum conception. It is this profusion of possible templates for action, and consequent actions, that is resolved in the von Neumann ontology by the occurrence of an "event", which selects one of the possibilities and eliminates all the others. This event is a mental event that is represented in the quantum mechanical conception of the physical world by a sudden change in the form of the probability wave, namely by a jump to a form that has all of the probability concentrated on the branch of the probability wave that represents this chosen course of action, and, correspondingly, a null probability assigned to all of the alternative possible branches. The actualized template for action is an extended physical structure in the brain, and it is supposed to embody all of the structural information that is contained in the mental event. Thus the mental and physical events can be considered to be two aspects of the same thing. Each event represents from the physical perspective provided by quantum mechanics a bona fide free choice from among open and available options.

5. Chance, Choice, and Meaning

This quantum conception of man breaks the bondage of an iron-handed mechanical determinism. Man becomes an aspect of the process by which nature uses the latitude, or freedom, expressed by the Heisenberg indeterminancy principle to inject form and structure into the universe. In the classical conception of nature all freedom to choose was concentrated at the moment of the creation of the universe, and hence none was reserved for later use. But quantum theory transferes this freedom to later times, and von Neumann's conception shifts some of it to our thoughts: our minds become endowed with some of the power to act freely that in classical mechanics was the prerogative of God alone.

Our choices are not reclused from meaning. Each choice is the expression of an intention. It arises within a context, and it initiates an action designed to promote certain values. The intention of the action and values it serves are integral parts of the felt act of choosing.

These qualities of the quantum event can be contrasted with the meaninglessness of random events that might be imagined to occur at some microscopic level. There it is impossible to embody in the physical structure actualized by the event any representation of intention or value that transcends the momentary situation. But the events of the von Neumann conception, which actualize extended physical structures that are imbedded in the interpretive mechanism provided by the brain and body, do embody intention, values, and meaning, all of which are felt at the mental pole.

A healthy brain is designed and conditioned to produce the actions most likely to serve the needs and values of the person, as judged from the perspective of that person. Of course, there are always uncertainties in our assessment of the physical situation, and fluctuations in the biological computing machinery. Hence different parallel brain calculations of the best course of action can come up with different conclusions. In the quantum ontology these parallel computations are all performed simultaneously, and the various options are all presented. The statistical weight assigned to each option is essentially the number of parallel classical computations that lead to that option. The simultaneous availability of all the options can be regarded as an expression of the freedom that is represented by the quantum indeterminateness of the physical situation. This indeterminacy makes the quantum choice a bona fide free choice, yet a choice that has only the latitude allowed by the underlying physical indeterminacy. The choice is thus at the same time both a free choice and yet, statistically speaking, in terms of the entire ensemble of weighted possible choices, also the unique best choice: this ensemble is roughly the statistical ensemble of computed best actions, given the indeterminateness of both the external situation and the internal computational machinery.

These choices are not blind choices, as they would be if they occurred at the microscopic level. For they are choices between options that project into the future actions that embody intentions based on our values. Our choices constitute value-laden intentions, and are thus endowed with meaning: they embody both the mechanically represented personal attributes arising from genes and education, and a freedom that transcends the mechanical.

This image of man is far more inspiring and liberating than the dreary picture painted by classical mechanics. Man becomes a partner in the control of his non-predetermined destiny, and an integral part of nature's process of infusing structure and meaning into the universe. He is an aspect of the power to freely create that classical mechanics reserved for God alone.

Beyond its re-instatement of freedom and meaning the quantum conception unveils a still deeper truth. This arises from an aspect of quantum mechanics not yet touched upon here, namely the deep-level of connectedness of spatially separated physical entities. Once two entities have interacted they become intrinsically intertwined in a way that is not physically apparent, and that moreover defies comprehension within the way of thinking that underlies classical mechanics and our common-sense understanding of nature. Yet it is entailed by quantum mechanics, and has been confirmed by delicate experiments in simple cases where sufficient control over the experimental conditions can be maintained. This deep-level connectedness entails that our choices, although highly personal in terms of their meaning to us, have another aspect that transcends the individual. A choice made by one person generally has an 'instantaneous effect' on the objective tendencies associated with far-away entities with whom he has interacted at some time in the past. It is as if the entire universe is, in some sense, a single organism whose parts are in instantaneous communication. This means that although each of us participates in an individually meaningful way in the process that infuses form into the universe, and can shape this process in accordance with his own personal values, nevertheless the process is basically one universal activity of which each of us is a highly integrated part. Quantum theory indicates that we are all, far more intricately than appearances indicate, facets of one universal process. Thus, according to the quantum conception of nature, the notion that any one of us is separate and distinct from the rest of us is an illusion based on misleading appearances. Recognition of this deep unity of nature makes rational the belief that to act against another is to act against oneself.

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