Quantum Indeterminacy & the Case for Freedom in Nature

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ABSTRACT: Hawking and Mlodinow affirm that quantum indeterminacy is not a departure from natural law. Indeterminacy leads us to redefine natural law as meaning that nature does not determine outcomes, but rather determines a range of probable outcomes. They unfortunately do not apply this to human beings. In contrast, we ought to explore the possibility that while most structures in nature statistically overwhelm quantum indeterminacy, creating physical determinism, the structures of living organisms may actually enhance quantum indeterminacy so that natural law applied to those organisms does not determine outcomes, but determines a range of probable outcomes. That is, freedom is inherent and important within nature.

KEY WORDS: Indeterminacy, determinism, freedom, quantum, Hawking, Whitehead, history

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Consider this passage from Stephen Hawking's and Leonard Mlodinow's 2010 book, *The Grand Design.*

> According to quantum physics, no matter how much information we obtain or how powerful our computing abilities, the outcomes of physical processes cannot be predicted with certainty because they are not *determined* with certainty. Instead, given the initial state of a system, nature determines its future state through a process that is fundamentally uncertain. In other words, nature does not dictate the outcome of any process or experiment, even in the simplest of situations. Rather, it allows a number of different eventualities, each with a certain likelihood of being realized. …
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> Quantum physics might seem to undermine the idea that nature is governed by laws, but that is not the case. Instead it leads us to accept a new form of determinism: Given the state of a system at some time, the laws of nature determine the *probabilities* of various futures and pasts rather than determining the future and past with certainty. (Hawking, 2010, 72 Emphasis original.)

Hawking and Mlodinow clearly describe a central feature of quantum mechanics, that natural law determines a range of probabilities, but not outcomes. Yet, in chapter two, in which they explained the idea of natural law, they assert about humans that "It is hard to imagine how free will can operate if our behavior is determined by physical law, so it seems that we are no

more than biological machines and that free will is just an illusion." (Hawking 32) I argue that this is an unnecessary incoherence.

Ideas, in science as elsewhere, are shaped by their history. Sometimes the shaping is by agreement with what has gone before, sometimes by angry rejection. But both influence how ideas develop. I want to consider two ideas which I think have shaped the language and conceptuality of modern science in unfortunate ways, and propose how we might move ahead more constructively to consider the place of freedom within nature.

First, we know that behind early modern science lies a long history of Christian theology which vigorously asserted the doctrine of total divine predestination. Divine omnipotence eternally determined all events. Within this theological framework, "freedom" meant only that God determined us "both to will and to do" (Philippians 2:13) so that our predestined action was determined by our predestined will. In response to Renaissance thinkers like Erasmus who proposed some degree of genuine free choice, Luther and Calvin adamantly denied any possibility of such freedom.

Is it any surprise, then, that among the many models available from early Greek philosophers, 16th and 17th century scientists choose as their model for nature the totally deterministic atomic model of Democritus and Leucippus? The vision of Galileo, Descartes, Leibniz, Newton and others, only reframed the historical theological assumption of total divine determinism into the language of natural mechanistic determinism.

Second, this emphasis on determinism was slightly loosened by another traditional Christian doctrine—that human beings stand at the center of creation and are in some important ways exceptions to the cosmic rules. Copernicus and Galileo were disturbing largely because they moved us out of the center of the universe. But Galileo's discovery of mountains on the

moon, and Newton's articulation of the laws of motion, went further to suggest that the earth is *not* an exception, but fits within the same universal laws as does everything else.

In response to the de-centering and demoting of humans beings, both Rene Descartes and Immanuel Kant sought to separate the human mind or soul from the physical or natural world. This preserved our sense of our own divinely established uniqueness, and also opened a way to support the Renaissance and Enlightenment hope that we humans might be partially in charge of our own destiny. Unfortunately, their proposals made us strangers in a strange land with regard to the rest of nature, small islands of supernatural behavior within a purely natural cosmos, and hence could not be sustained in the advance of modern science.

I argue that the combined inheritance of the presumption of total determinism, and the legitimate scientific rejection of any effort to view human minds as exceptions to natural laws, have jointly boxed us into an unfortunate rejection of any possibility of freedom within nature, a rejection which is unnecessarily dogmatic and strongly challenged by widely shared and recurrent human experience.

First, note that when we speak of quantum events as indeterminate, we are already reflecting the historical prejudice in favor of determinism. Why not say that *freedom* is inherent within quantum events? By freedom I propose the simple root meaning of the power to act in more than one way in any context. Consider how different the entire scientific conversation would be if we had begun from a presumption of freedom in nature and humanity, and had then created language to denote the levels of nature in which that freedom to act was powerfully restrained or enhanced. Or, what if we had begun with Heraclitus's image of fire—dynamic energy events—at the root of nature and never had the language of "particles" which seem to endure fixed and unchanging for all eternity? Surely, it makes little sense to preserve the

language of unchanging atomic particles when quantum mechanics so thoroughly rejects such an image. Yet, the power of the history of our language and ideas is preserved in ways which can fundamentally mislead our thinking.

Furthermore, while I fully agree that we must reject any suggestion that human psyches are exempt from the universal laws of nature, why must we then so dogmatically insist that the powerful evidence of our own internal experience of freedom is purely illusory?

I suggest that we do, in fact, experience in ourselves *exactly* what Hawking and Mlodinow describe--that in natural processes, even given the force of past events, "nature does not dictate the outcome of any process or experiment, even in the simplest of situations. Rather, it allows a number of different eventualities, each with a certain likelihood of being realized." Why is it so impossible to take our own internal experience of making free choices *within a range of possible outcomes* as legitimate evidence in understanding nature, especially when that evidence is so overwhelmingly supported by the evidence that such freedom (indeterminacy) is inherent in nature at its very roots? Why must we consistently dismiss our own experience of making choices as pure illusion, rather than seeing it as consistent with the evidence of quantum level natural laws?

Hawking and Mlodinow understandably presume an important argument. In most objects in nature, at the macro level the freedom (indeterminacy) of quantum events is overridden by the sheer weight of statistics so that events become "unfree" (deterministic). This is clearly true. But why must it be true in all cases? Why can we not distinguish between those inanimate structures which reduce the influence of quantum freedom and those living structures which function to build on and expand the range of freedom present at the root levels of nature?

Consider the possibility that in living organisms, like quantum events, natural law determines a range of possible actions, but not outcomes. What if natural law applies to living organisms and animal minds, in a manner yet to be clarified, in the same way it applies to quantum events? Why should this seem strange to us?

Scientists, with good reason, have long been suspicious of anything which smacked of anthropomorphism in natural science. It is so easy for us to create the universe in our own image. This suspicion gave rise to behaviorism in psychology, in which we described *only* behavior-- not any imagined and unobservable inner states of feeling. But more recent science acknowledges the inescapable fact that humans and at least some other animals do have inner states. We feel pain, pleasure, affection, anger, and other emotions which shape our behavior. And, we make choices among a range of possibilities. It approaches the absurd to deny that these inner states are in any way causes of our behavior since we experience such causal connections in every moment of our conscious lives, and can reasonably infer such causal connections in other animals given the similarities in their biological structures and observable behaviors.

I propose that we simply see human beings as part of a continuum of organisms and structures which, in widely varying degrees, either stifle or enhance and complexify the freedom which Hawking and Mlodinow so clearly describe as basic to natural law. "[N]ature does not dictate the outcome of any process or experiment, even in the simplest of situations. Rather, it allows a number of different eventualities, each with a certain likelihood of being realized." The range of possible outcomes can be narrowed or expanded by different kinds of structures-- basically nonliving or living--within nature, without making humans exceptions to the rules.

The mathematician and philosopher, Alfred North Whitehead, noted the incoherence of refusing to fully integrate living organisms and human beings into nature.

> It is the accepted doctrine in physical science that a living body is to be interpreted according to what is known of other sections of the physical universe. This is a sound axiom; but it is double-edged. For it carries with it the converse deduction that other sections of the universe are to be interpreted in accordance with what we know of the human body. (Whitehead, 1978, 119)

Whitehead challenged the historical assumption of determinism, with its linguistic bias against freedom, and suggested that we speak of quantum uncertainty in terms of "decision." "The word **'**decision' does not here imply conscious judgment, although in some 'decisions' consciousness will be a factor. The word is used in its root sense of a 'cutting off.'" (Whitehead, 43) That is to say, when a quantum event acts one way rather than another, it actualizes some possibilities while cutting off others. By inserting the word "decision" here, Whitehead sought to shift the historical and linguistic bias against freedom within nature, and to argue that freedom is inherent in nature, while existing along a very long continuum from most trivial to far more complex.

Whitehead argued from the observation of living organisms, which clearly show significant degrees of novel response to their environments similar to quantum indeterminacy but with much great ranges of possibilities. "Life is a bid for freedom... " he argued. (Whitehead 104) " It is obvious that a structured society may have more or less 'life,' and that there is no absolute gap between 'living' and 'non-living' societies." (Whitehead 102) That is, freedom is not an all or nothing affair. It emerges in a growing continuum from the roots of nature up through the more complex living organisms.

> In the case of those actualities whose immediate experience is most completely open to us, namely, human beings, [our experience of freedom] is the foundation of our experience of responsibility. ... of self-approval or self-reproach, of freedom, of emphasis. This element in experience is too large to be put aside merely as misconstruction. It governs the whole tone of human life. (Whitehead 47)

Whitehead's argument was empirically grounded. He insisted that "The ultimate test is always widespread, recurrent experience..." (Whitehead 17) Whatever our philosophical or theological claims to believe in determinism or predestination, human beings are constantly confronted with the demand that we choose between a range of possible actions, and we feel responsible for those choices. Even the most ardent determinist must still face these intractable, widespread, and recurring experiences, however much they may stand against deterministic theory.

There is simply no reason inherent in science why quantum indeterminacy must have zero significance for our larger vision of nature. It would be far more coherent to look for ways in which the freedom which lies at the roots of nature—demonstrated by a century of solid experimental evidence—emerges in layers of complexity in nature, and is found among other places in our own human experience as demonstrated in our most inescapable and persistent experiences of choosing between a range of possibilities.

I argue that Hawking, Mlodinow, and other scientists who apply only full determinism to human beings and other organisms, are ironically and erroneously reacting to the opposite mistake made by those who once insisted that we are divinely unique. In an effort to strip us of all such divinely given uniqueness, they end up failing to see how much more coherently all of

nature could be understood if we explore the possibility that living organisms increase rather than reduce the complexity of freedom inherent at the quantum level. Such a simple shift could affirm our rejection of the last vestige of the old supernaturalism which made humans uniquely immune to natural law, while opening us up to powerful new ways of exploring the implications of quantum mechanics for the study of life and mind within nature.

What Hawking and Mlodinow say of quantum indeterminacy (freedom) can also be said of living organisms as structures which build on and increase the complexity and range of the freedom which lies at the roots of nature. By seeing freedom as inherent in living organisms, we could then more rightly quote Hawking and Mlodinow as speaking about life when they say that acknowledging freedom within nature "might seem to undermine the idea that nature is governed by laws, but that is not the case. Instead it leads us to accept a new form of determinism: Given the state of a system at some time, the laws of nature determine the *probabilities* of various futures and pasts rather than determining the future and past with certainty."

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