# FREEDOM, CONSCIOUSNESS, AND INDETERMINISM: EXPLORING THE INCOMPATIBILITY OF QUANTUM MECHANICS AND FREEDOM OF THE WILL

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OVER THE PAST few centuries, the forum of the freedom of the will debate has shifted from the realm of philosophy of religion to that of science, and more specifically, physics. In the eighteenth century, the development of Newtonian Mechanics made the reformulation of arguments against free will possible. Rather than focusing the debate on questions of divine instantiation of freedom during creation and the like, arguments that relied on the fantastic tool of physics (as it appeared a quite deterministic physics) allowed philosophers to deny free will without even mentioning divinity or humanity's origins. Debates over the compatibility of free will and determinism became the battlegrounds upon which campaigns for freedom of the will could be waged. With the advent of quantum mechanics, however, the forgone conclusion of determinism's truth seemed premature. Many interpretations of quantum mechanics categorically deny the complete deterministic evolution of physical systems. This advent left room for free will as an empirical possibility even for philosophers who believed it to be incompatible with determinism. In this paper we will explore the extent to which various accounts of the collapse postulate in canonical theory of quantum mechanics could allow for an instance of incompatiblist free will. We will begin by taking a look at typical arguments for the incompatibility of free will and determinism, outlining how libertarian notions of freedom differ from typical compatiblist ones. We will discuss Barry Lower's arguments against the compatibility of the Ghirardi-Rimini-Weber account of quantum mechanics and libertarian free will. We will then explore the Wignerian account, offering two arguments for its incompatibility with libertarian freedom. We will conclude with an analysis of Robert Nozick's notion of free will and its degree of success in offering an intelligible account of freedom ensuring non-predetermined, non-arbitrary, mental processes.

The concept of a libertarian freedom of the will, which depends upon the possibility of events that are not predetermined, is argued by

some to be a true state in which people have free will. Libertarians are incompatiblists: they argue that some sort of indeterministic process must occur as a necessary condition for freedom of the will. The argument for determinism's incompatibility with free will has taken many forms. A generalized incompatibility argument can be stated as such:

1) There exists a time *t* when an agent has no influence on the state of the world P at time $t_0$.
2) An agent cannot influence a complete account of the laws of nature L.
3) P and L logically imply a determinate future state of the world F.
4) For any Q, R: if an agent has no influence on Q, and Q logically implies R, then given Q an agent is not free to influence R.
5) No agent is free to influence F.[1]

Premise (1) is at least supported by the existence of a time before one's birth when no agent has any effect on the state of the world. Premise (2) is certainly acceptable for human agents if L is taken to be a deterministic account approximating Newtonian mechanics.[2] Premise (3) is also dependent on a deterministic account of L. If L turns out to be chancy, as it does in quantum mechanics, then the conjunction of P and L will not imply a determinant future state of the world F. Depending on how chancy L turns out to be, the conjunction of P and L could imply anything from a probabilistic account of F to (in the case that L is utterly chaotic) almost nothing about F at all. However, if it is accepted that L is deterministic, then (3) seems easily supported. Most compatiblists chose to challenge premise (4). One such compatiblist rejection of (4) involves counterfactuals of the sort:

**(A)** J could have done other than X ≡ **(B)** J would have done other than X, if J had willed other than X

The compatibilist uses this equivalency to deny premise (4), challenging the use of the term 'free' in the consequent of the inference. The compatibilist argues that (A) logically implies that J wills to do X freely. Hence, according to the compatibilist, since counterfactuals such as (B) are sometimes true, sometimes, J freely wills X. Compatibilist accept that P and L logically imply F, but in cases where counterfactuals such as (B) are true, they assert that an agent is free in influencing F, thus contradicting the implication of premise (4).[3] Of course, compatibilists have made many other attacks on premise (4) and offer various justifications of the above equivalency or modifications of it. Unfortunately, an adequate synopsis of the many different arguments is a daunting task well beyond the scope of this

paper. It suffices to note that debates over the truth of (4) rest on competing conceptions of what qualifies as freedom in reference to the will.

The incompatibilist argument assumes the contingent possibilities that L is both deterministic and cannot be influenced by agents. If premise (4) is accepted, is it possible to modify the incompatibilist argument so that free will is still rejected when assumptions about the nature of L are challenged?[4] First we will analyze what a rejection of (3) would amount to. Premise (3) asserts that P and L are sufficient for predetermining F (i.e., that L is deterministic). The alternative would be to consider an indeterministic L. What would it mean for L to be indeterministic? The most straightforward notion of an indeterministic L is one that describes the evolution of the state of the world as chancy. If L were chancy, then it would not follow that P and L logically imply a single future state of the world F; rather, they might imply a set of F's, each with its own probability assignment. Though considering a chancy L seems to be the clearest method of interpreting what an indeterministic set of laws could be, some posit the existence of additional formulations of L which are neither random, nor arbitrary.

Libertarian free will is an incompatibilist notion that, while accepting (4), posits the existence of free will in cases where (3) is false. The libertarian notion of free will states that an agent's action was free if and only if that action was up to her and nothing else. In other words, it requires that an agent be the ultimate originator for her actions (i.e., the cause of the action did not originate from something external to the agent). Robert Kane offers the following notion of ultimate responsibility (UR) as a necessary condition for such freedom ensuring ultimate origination:

> (UR) An agent is ultimately responsible for some (event or state) E's occurring only if (R) the agent is personally responsible for E's occurring in a sense which entails that something the agent voluntarily (or willingly) did or omitted, and for which the agent could have voluntarily done otherwise, either was, or causally contributed to, E's occurrence and made a difference to whether or not E occurred; and (U) for every X and Y (where X and Y represent occurrences of events and/or states) if the agent is personally responsible for X, and if Y is an arche (or sufficient ground or cause or explanation) for X, then the agent must also be personally responsible for Y.[5]

The libertarian posits that if L were completely deterministic, then the (U) component would not be satisfied for any agent in regards to any

action X. There would always exist a Y that extends beyond that for which the agent is personally responsible.

A libertarian is a type of incompatibilist who leaves open the possibility of free choices or actions that are not predetermined by the conjunction of P and L. But what sort of indeterministic L allows for an agent to choose freely in a way that satisfies the requirements of being personally responsible for the choice in a non-arbitrary way? If a choice originating from an agent is not causally determined by any state of affairs that resulted in the present condition of the agent, how then could her choice be anything other than random or arbitrary? It is clearly important that such choices are not made arbitrarily, for if they were, it would be incredibly difficult to say that the agent is ultimately responsible for making her choice. In such scenarios, one might argue that it is not the agent in question who is responsible for an arbitrarily arising state of affairs, but the *absence* of causation (probabilistic or determinate).

In his *Philosophical Explanations*, Robert Nozick attempts to answer the above questions.[6] Nozick asserts that in certain types of indeterministic worlds, it is possible for an agent to be ultimately responsible for certain choices she makes by means of a nonrandom, nonarbitrary, indeterministic process. Nozick interprets the decision-operation as the process of considering the various reasons for each possible course of action, then assigning a weight to each of the reasons and choosing the option that has the most compelling reasons. However, Nozick maintains in his model that the assignments of weights to reasons (at least with regards to a certain special types of decisions) are not previously causally determined. He states that though a reason's existence may be causally determined and though the assignment of greater weight to those reasons causally determines the actual act, the operation of weight assignment itself is not causally determined by prior states of the world.[7] He compares an agent's mental state prior to choosing to a quantum mechanical superposition. According to the quantum mechanical evolution of physical systems, occasionally, the mathematical algorithm representing such systems describes a physical state where certain physical particles or groups of particles possess in a sense multiple positions or states at the same time. In such a situation, the physical particles are said to be in a 'superposition' of states. According to the canonical interpretation of quantum mechanics, if left on their own to evolve, a superposed particle may evolve on two completely independent paths that may or may not reconverge. If, however, a superposed state of a particle or group of particles is measured, then what is termed a 'collapse' occurs. A collapse is the indeterministic evolution of a superposed particle

where, according to certain discoverable probability frequencies, the particle assumes one and only one of its various superposed states. Nozick compares an agent's mental state prior to choosing to a quantum mechanical superposition in the following way:

> A person before decision has reasons without fixed weights; he is in a superposition of (precise) weights, perhaps within certain limits, or a mixed state (which need not be a superposition with fixed probabilities). The process of decision reduces the superposition to one state (or to a set of states corresponding to a comparative ranking of reasons), but it is not predictable or determined to which state of the weights the decision (analogous to a measurement) will reduce the superposition.[8]

According to Nozick, the process of making a decision amounts to "collapsing" a "superposition" of different possible weight assignments for each list of reasons to a single assignment, resulting in the agent's choice.[9] Let us call such a process '*decision collapse*'. It is important to note that Nozick does not insist that quantum mechanics represents a necessary or sufficient type of L for ensuring the sort of libertarian free will that he is suggesting. Rather, he compares the process of choosing that he supports to the explicitly indeterministic events described by the collapse postulate of quantum mechanics. Before analyzing whether Nozick sufficiently shows that such a decision process can be indeterminate and non-arbitrary, let us explore first whether quantum mechanics provides an adequate analogue for his notion of decision collapse, and second, which, if any, of the interpretations of quantum mechanics provide sufficient possibility for the actual existence of libertarian free will.

The first problem surrounding Nozick's analogy concerns the nature of what it means to be in a superposition. In his *Freedom from Physics: Quantum Mechanics and Free Will*, Barry Loewer correctly points out that, if decision-making *were* like quantum mechanics, then, as per mathematical linearity of the quantum mechanical algorithm, before making a choice, an agent in a superposition of weight assignments would report that she had already made up her mind. If an agent were in a superposition of (1) weighting the reasons for option A as greater than the reasons for option B, and (2) weighting B as greater than A, then, according to the algorithm of quantum mechanics, both possibilities are states in which the agent would say that she had already made up her mind. According to the linearity of the Schrˆdenger equations (equations describing the physical evolution without collapses of quantum mechanical states), before making a

choice, a competent agent would in fact report that she had completed her decision. However, this description clearly does not depict how the decision-making process actually occurs: if a competent agent has not yet made a choice, then she will report that she has not yet made her choice. Though this shows that Nozick misapplies the notion of superpositions, such an error is not fatal to the analogy in general. An account of libertarian free choice might be formulated so that such a discrepancy would not occur.

In order to examine which, if any, of the interpretations of quantum mechanics provide sufficient possibility for the actual existence of libertarian free will, we must first determine which interpretations are applicable. Since any libertarian notion of free choice requires the absence of a completely deterministic L, we can immediately rule out all quantum mechanical interpretations that are completely deterministic. Hence, David Bohm's theory, as well as theories that have grown from Hugh Everett's work can be grouped along with Newtonian mechanics,[10] which are already supposed to be incompatible with the libertarian notion of free will. All that remains are interpretations of the canonical theory of quantum mechanics that attempt to reconcile the measurement problem by sharpening the notion of a measurement. In considering the possibility of libertarianism, we will address the Ghirardi-Rimini-Weber theory (GRW), which includes a sharpened notion of the macroscopic/microscopic distinction, as well as Wigner's theory, which at least localizes the ambiguity of the measurement problem to the vague distinction between conscious and not conscious.

Loewer argues against the notion of libertarian free will under a GRW interpretation by appealing to the concept of *probabilistic causation*.[11] He offers the following definition of probabilistic causation:

> (P) If e is a chancy event (i.e. at times prior to its occurrence there are objective chances of its occurring or not occurring), then if c causes e, it does so by altering the chance of e (at the time immediately after c) or by altering the chance of some event in a causal chain leading from c to e.[12]

He claims that any world with an objectively indeterministic L is just as incompatible with free will as a world where L is deterministic. An objectively indeterministic L is any L where the only way to influence F is by probabilistically causing the chances of a certain state of F to increase.[13] The GRW interpretation of quantum mechanics is an example of such an objectively indeterministic L. The incompatibilist's

argument can be modified in the following way:
1) There exists a time *t* when an agent has no causal influence (probabilistic or otherwise) on the state of the world P at time $t_0$.
2) An agent cannot influence a complete account of the laws of nature L.
*3) P and L logically imply a set of possible future states of the world F and assign an objective probability to each of the possible F's so that the sum of the probability of each possible F = 1.
4) For any Q, R: if an agent has no influence on Q, and Q logically implies R, then given Q an agent is not free to influence R.
*5) No agent is free to influence the set of possible F's or the probabilities of occurrence assigned to each possible F.
Thus, with a few minor alterations, Loewer is able to reduce the possibility of free will under an objectively indeterministic L to the same status it has under a deterministic L. The compatibility of free will with both objective indeterminism as well as determinism rests upon the acceptability of the inference in premise (4).

Though he rejects the compatibility of GRW with free will, Loewer accepts free will's compatibility with a Wignerian interpretation of quantum mechanics (WQM). According to Loewer, it is conceivable that WQM allows for a conscious agent to be ultimately responsible for her choice whenever her choice results in a collapse that provides the indeterministic evolution necessary for libertarian freedom of the will. Loewer asserts that such a collapse would, in a sense, constitute an actual sort of decision collapse similar to the type posited by Nozick. Of course, Loewer does not assert that this establishes what Nozick had in mind when he discussed the notion of decision collapses. As we shall see later, it is quite unlikely that Nozick would assert that a Wignerian decision collapse ensures his form of libertarian freedom. However, Loewer does accept such a Wignerian decision collapse as a valid means of allowing free will. Nevertheless, he rejects the empirical truth of WQM and denies that such a possibility of allowing free will provides sufficient proof for WQM.

In order to determine whether Loewer correctly states that WQM ensures the possibility of a libertarian freedom of the will, we must analyze what a Wignerian decision collapse means. WQM states that collapses occur just in case a conscious agent observes a quantum mechanical superposition. The obvious weakness of the theory lies in the ambiguity of what is meant by 'conscious agent'. Consciousness is a vague term; the necessary complexity of a conscious agent's brain structure, or (so we do not rule out the possibility of unknown, alien, or artificial conscious agents) let us call it the agent's '*operating system*', is clearly unknown. Most would agree that while a human is

conscious, a fruit fly (or if that is not weak enough, a bacterium) is not. But what about a dog or a gorilla? Immense ambiguity surrounds the term 'conscious agent'. In order to tighten the vagueness a bit, I propose the following necessary (although probably not sufficient) condition for consciousness:

> (C) An agent is conscious only if there exists a subsystem S of the agent's operating system of sufficient complexity with the capabilities of monitoring and interacting with a sufficiently large portion of the entire operating system.

The terms 'sufficient complexity' and 'sufficiently large portion' have purposefully vague functions. The quality of sufficient complexity is what might restrict, for example, a personal computer from satisfying (C). A desktop PC certainly does contain an S capable of monitoring and interacting with a majority or all of the PC's operating systems and programs. However, most would agree (if they believe it is possible for a computer to achieve consciousness at all) that a modern PC fails to satisfy (C) because the S is not sufficiently complex. The subsystem S of a PC is a subsystem that is qualitatively insufficient for satisfaction of (C), and thus a PC does not posses the quality of consciousness. Similarly, an S of sufficient complexity that possesses only the capability of monitoring and interacting with the state of 4 neurons, transistors, etc. would also fail to satisfy (C) because it is not quantitatively the right sort of subsystem.[14] Thus it seems that principle (C) is at least a necessary condition for consciousness. An attempt to discern what counts as a conscious observation only magnifies the ambiguity. If we accept principle (C) as a necessary condition for consciousness, then it seems as though such a subsystem S plays a vital role in bringing about collapses according WQM. Let us assume, according to WQM, that a collapse occurs just in case the S of a conscious agent monitors or interacts with parts of an operating system that have become entangled with a superposition of states.

With the above sharpenings of WQM, we now have the necessary tools to analyze what could occur in a Wignerian decision collapse. Such a process presumably starts with a quantum mechanical superposition of states of which an agent (and hence her S) is not aware. In a Wignerian picture, as long as the agent's S has no cause to monitor or interact with the superposed system, such an unobserved superposition continues to evolve deterministically according to Schrˆdenger's equations of motion, becoming increasingly entangled with the agent's operating system. If such a state progresses sufficiently, unobserved by the S, then in the event that the agent is faced with a decision that requires accessing entangled parts of the

operating system, the S shifts its attention to the entangled portions, collapsing the superposition in retrieving the information. Then, assuming there are no further entanglements, the agent's operating system evolves deterministically in the newly collapsed state, resulting in an eventual choice.

This story describing the possibility of a Wignerian decision collapse does possess a certain appeal. It is conceivable for an agent's operating system to become quite superposed without her ever realizing it. Let us suppose, for example, that an agent's brain evolves into the superposition of wanting an apple and wanting a banana. By the linearity of the Schr^denger's equations, the state of the agent wanting or not wanting fruit is completely unentangled (i.e., it is not in a superposition as is the choice of fruit type). If we suppose the existence of a subsystem S'πS in the agent's brain that is responsible only for retrieving information about whether or not she desires fruit, then, if asked if she desires fruit, she would honestly, competently, and correctly answer "yes." Similarly, if we asked her if she knew what sort of fruit she wanted (assuming an appropriate S' is available), her honest and competent (though incorrect) answer would again be "yes." And if we asked her whether she desired an apple or a banana, then her S would at last "look" at the superposed part of her brain, collapse the wave function, and her answer would be either "apple" or "banana" with an appropriate probability of either option obtaining. One might claim that such a scenario is guilty of the same sort of misapplications as is Nozick's notion of decision collapse. The above scenario does not make the same error, however, because we stipulated the existence of an S'. Whether the agent's brain is entangled or not, S would still have to access the part of the brain containing the actual information about which fruit the agent wants. This process of accessing is more appropriately called the decision process. Furthermore, if we were to ask a superposed agent if she knows which fruit she wants, she would either: (a) actually access the entangled parts of the brain, initiate a decision collapse, store the decision, and respond "yes", or (b) would access an appropriate S' that is also in an entangled superposition, which would likewise result in a decision collapse, and a determinant value of either "apple" or "banana" stored in her brain. Either way, the decision collapse would occur before she responded that she knew her choice. An accurate S' would not be able to report to an S which fruit she wanted without becoming entangled with the superposed parts of her brain. It would be impossible for an accurate S' not to become entangled with the superposition of decisions. Thus, a Wignerian decision collapse is not subject to the same sort of fallacy associated with Nozick's analogy of a decision collapse. Furthermore, the theory

predicts that decisions we make appear precisely as they do. Agents are not conscious of their brains being in a superposition of states because the moment an agent considers the superposed parts of her brain, the superposition collapses. However, the question remains, does a Wignerian decision collapse allow for freedom of the will?

One could pose two arguments for why WQM is incompatible with a libertarian notion of free will. First, when discussing non-predetermined free choices, the libertarian almost certainly means non-predetermined *conscious* free choices. However, as demonstrated above, an agent is necessarily unconscious of the indeterministic parts of the processes of decision collapse. The state of the world (including an agent's operating system) evolves deterministically according to equations of motion until the S of a conscious observer "looks" at a portion of the world, instantaneously disentangling and collapsing all observable superpositions of states. By the laws of WQM, an agent is not conscious of a collapse because before she even considers the decision, the collapse has already happened. Following the collapse, the decision process once again continues to evolve deterministically. Thus the only part of a decision collapse free from predetermination is a part of which the agent is not even aware. This is not what libertarians have in mind when considering the notion of free will. If the agent is to be ultimately responsible for her free choices, she needs to be ultimately responsible for what her choices actually turn out to be, not unconsciously responsible for causing a different set of laws to probabilistically determine the state of the world before the decision process even begins.

Second, the truth of WQM allows one to reject (or at least partially reject) a premise of the incompatibilist's argument which thus far has been incontrovertible. Premise (2) states that an agent cannot influence a complete account of the laws of nature L. But in the case where L is WQM, a conscious agent can, in some sense, influence the laws. A conscious agent does have the capability of influencing when and where certain laws of WQM take effect while others do not. According to WQM, a conscious observer can influence where the laws governing collapses must occur by merely making herself conscious of the state of affairs in the designated area. When no conscious agent observes an entangled state of the world, that portion of the world evolves completely deterministically. Otherwise, all observed entangled superpositions immediately collapse, but the conscious agent does not influence (probabilistically or otherwise) an increase or decrease in the chances of a superposition collapsing to one state or another. Under the observation of a conscious agent, the world evolves in an objectively indeterministic way. Though in a limited sense she has an option of

which laws apply at which times, a conscious observer is still not able to influence how the laws work. She does not have the option of choosing neither a deterministic L nor an objectively indeterministic L. When a conscious agent's S is not conscious of part of her operating system, then a deterministic L applies. When she is conscious of it, an objectively indeterministic L applies. By the same logic used in Loewer's argument against objective indeterminism, under WQM even a conscious observer is unable to influence the probabilities assigned to each of the possible states of superpositions. WQM does not change the fact that both a completely deterministic L and an objectively indeterministic L are incompatible with the libertarian notion of free will. Thus, an L that is a disjunction of deterministic and objectively indeterministic sets of laws is also incompatible with the libertarian notion of free will. Wignerian decision collapses do not allow for libertarian freedom of the will.

Thus far, we have examined three logical constraints on the libertarian notion of free will. First, as Loewer suggests, the notion of decision collapse as a means for allowing free will cannot be correct as originally formulated by Nozick. Second, as demonstrated by Loewer, the same argument for the incompatibility of free will and determinism, which is accepted by libertarians, can be modified to show that free will is also not compatible with objective indeterminism. Since the libertarian maintains that free will is possible just in case the physical evolution of the world is not deterministic, Loewer's argument seriously hinders the libertarian's reasons for accepting the existence of free will in the face of quantum mechanical interpretations such as GRW. Last, we have provided two arguments for why the notion of a Wignerian decision collapse does not allow for a libertarian notion of free will. Under the interpretation of a Wignerian decision collapse given above, an agent would necessarily be unconscious of the undetermined part of the decision process. A conscious agent can never be aware of the very part of the decision that the libertarian must insist allows for her freedom. Furthermore, the indeterministic evolution of the world caused by a conscious agent's observation is incompatible with libertarian free will for the same reasons that GRW-like interpretations are. Thus, it appears as though no interpretation of quantum mechanics (indeterministic or deterministic) is compatible with a libertarian freedom of the will.

Let us return now to Nozick's notion of free will. Nozick posits that his analogy is just that, merely an analogy. He asserts that his notion of free will provides an account of undetermined free will deriving ultimately from the agent while still remaining rational, non-random and non-arbitrary. Perhaps, if we ignore for a moment the

incongruency of his analogy and take a closer look at his theory, Nozick will be able to provide a libertarian account of free will that is unhindered by the other two constraints on the libertarian notion of free will offered thus far. In order to explore whether this is possible, we must first take a much closer examination of Nozick's theory.

Recall that Nozick asserts that a free choice occurs by a non-causally determined process of assigning weights to reasons.[15] He formalizes the process as such:

> As the person is deciding, mulling over reasons $R_A$ which are reasons for doing act A and over $R_B$ which are reasons for doing act B, it is undetermined which act he will do. In that very situation, he could do A and he could do BÖ ÖWhichever he decides upon, A or B, there will be a cause of his doing it, namely $R_A$ or $R_B$. His action is not (causaly) determined, for in that very situation he could have decided differently; if the history of the world had been replayed up until that point, it could have continued with a different action.[16]

Nozick's formulation is quite ingenious. He postulates that a decision is free because a non-predetermined weighing of reasons causes it. Regardless of whether he is correct about other qualities, such a choice certainly cannot be accused of being irrational. On the contrary, such a choice by construction follows from reasons available to the agent. Furthermore, Nozick's formulation certainly consciously involves the agent in the non-predetermined part of the decision in the way that the Wignerian decision collapse does not. The real challenge that Nozick faces is demonstrating that such a decision collapse is neither random nor arbitrary. If Nozick cannot sufficiently dodge these challenges, then one can argue that randomness or arbitrariness, and not the agent, is ultimately responsible for the result, thus denying the agent's free will.

In accounting for why such a weight bestowal is neither random nor arbitrary, Nozick appeals to the notion of *reflexive self-subsumption*. A self-subsuming assignment of weights justifies both the action and the actual bestowal of the weight. He goes on to assert that such assignments are reflexive because they allow one to retrospectively refer to the bestowal of the weight assignments as the reason for doing so. Nozick offers choosing a "conception of oneself and one's appropriate life, a conception that includes bestowing those weights and choosing that conception"[17] as an example of a reflexive self-subsuming decision. Presumably, assigning more weight to the reasons for choosing conception of one's self X than the reasons for

choosing conception of one's self Y subsumes such a bestowal. The agent, as an instance of her X-conception of herself, assigns weights favoring X. Nozick asserts that such reflexive self-subsuming decisions are thus not causally determined, yet remain nonrandom. This line of thought is highly complex. It represents a considerable attempt to outline what it would mean to be indeterminate, but not random. Furthermore, such reflexive self-subsuming choices appear to maintain complete autonomy, another important quality of a free choice. However, even if such choices do represent valid examples of what nonrandom indeterminate events would look like, there still remains the question of why one such choice occurs and hence reflexively subsumes itself over another possible reflexive self-subsuming weight assignment.

Nozick responds to questions concerning why one reflexive self-subsuming assignment obtains over another by insisting that they are unfair questions. He carefully hedges around the notion that such a question is unanswerable because of our inability to discursively explain what we mean when we use terms like 'free choice'. At the heart of his theory he offers the following response to such questions:

> [I]t might be demanded that the theorist of free will show how the decision is causally determined. Otherwise, it will be said, the character and nature of the decision will remain mysterious. But clearing up any mystery in that way would come at the cost of the act's contra-causal freedomÖ Free will is to be explained differently, by delineating a decision process that can give rise to various acts in a nonrandom nonarbitrary way; whichever it gives rise to – and it could give rise to any one of several – will happen nonarbitrarilyÖ What is inappropriate is to demand that a free choice be explained in a way that shows it is unfree.[16]

We are left with the question: what L, if any, is compatible with Nozick's formulation of a free choice? What happens if we assume that a Nozickian collapse can consist of any physically indeterminate process that leads to the assignment of weights to different reflexive self-subsuming choices? If we adopt an interpretation of quantum mechanics with a version of the collapse postulate, then, much in the spirit of the Loewer argument, we might want to appeal to the randomness of collapses, arguing that while a reflexive self-subsuming choice is not itself arbitrary, there is a sort of meta-arbitrariness to its instantiation. Pushing Nozick's theory further than it extends would be doing exactly what he insists in unacceptable. It makes such a notion

of free will vulnerable to the arguments posed earlier in this paper; it would "demand that [Nozick's theory of] free choice be explained in a way that shows it is unfree."

This is the fundamental impasse that lies at the heart of many debates concerning freedom of the will. Nozick does much to delineate the extent to which the libertarian notion of free will can be justified. He inserts a vast amount of ingenuity in his formalization of a nonarbitrary non-predetermined free choice. But alas, such an argument does not and cannot provide unlimited explanation. He states that all notions of compatibility (traditional determinism ones as well as the ones focused on in this paper) must rest on the mystery of non-discursively explained notions. At the foundation of the problem, questions concerning freedom of the will depend stubbornly on what one really expects of such a notion.

In this paper, we have not explored the soundness typical arguments for the incompatibility of free will and determinism. The ongoing debate over such questions rages on. One thing is clear however, freedom of the will's compatibility with any account of physics stems fundamentally from what we expect of freedom of the will. Libertarians, demand further constraints of ultimate origination in their notions of free will. They attempt to dodge the problem of external predetermination by insisting on the existence of internal, non-arbitrary, indeterministic, mental processes. We have explored several arguments asserting free will's incompatibility with different interpretations of quantum mechanics. The arguments demonstrate that indeterministic accounts such as GRW and Wigner's interpretation, along with all deterministic accounts of quantum mechanics, appear to be just as incompatible with the notion of free will as are more classical accounts of mechanics. Though we have not completely ruled out the possibility of a clearly delineated account of such libertarian freedom ensuring processes, we have established that quantum mechanics will not do the trick. As it stands, it doubtful as to whether any accounts of such processes (whether quantum mechanical or otherwise) might be successfully formulated unmysteriously. As Nozick concedes, to do so would be to give an account of libertarian free will "in a way that shows it is unfree."

## NOTES

[1] Peter Van Inwagen offers a different form of an incompatibility argument in his *The Incompatibility of Free Will and Determinism*, printed originally in *Philosophical Studies* **27** (1975), pp. 185-99. However, for the purposes of this paper, his formulation of the argument is comparable to the one given above.

[2] The E.P. Wigner interpretations of quantum mechanics may make the

acceptability of (2) a bit less clear. According to Wigner's interpretation, though agents cannot change the structure of L, conscious agents do have the capabilities of influencing how L works (i.e. when indeterministic quantum mechanical collapses actually occur). The effects this has on the argument will be addressed later.

[3] The given equivalency was first addressed by G. E. Moore in his *Ethics* (London, 1911) ch.6. Since then, many exchanges regarding the validity of the equivalency have taken place. Most notably is a debate that took place in *Analysis* in 1967-8: See Bruce Aune, "Hypotheticals and 'Can': Another Look," *Analysis* **27**, pp. 191-195. See also Keith Lehrer, "Cans Without Ifs," *Analysis* **29**, pp. 29-32.

[4] This will amount to a rejection of one or both of premises (2) and (3). A rejection of (1), though not within the scope of this paper, also leads to an analysis of important philosophical merit. The question as to whether an agent whose temporal duration extends as far back into the past as does the world in which he or she exists leads to intriguing insights on the free will problem. Robert Nozick flirts with such questions in his *Philosophical Explanations* (Cambridge: Harvard University Press, 1981) pp 314-315.

[5] Robert Kane, *The Significance of Free Will* (New York: Oxford University Press, 1996), p 35

[6] Nozick, *Philosophical Explanations*, 1981. Section 4, "Free Will"

[7] Nozick 1981: p 295.

[8] Nozick 1981: p 298.

[9] Nozick asserts that it is not necessary that specific weight quantities be assigned to each reason, rather, a general strict inequality of weight totals can be given. Thus a superposition of assignments need not have that many terms; it is enough to be in a superposition of n possible assignments, each one rating a different one of the n options with the greatest weight of reasons.

[10] These theories offer interpretations of quantum mechanics that attempt to deny the collapse postulate, hence removing all indeterministic elements.

[11] The GRW theory suggests that all particles are constantly undergoing collapses with an incredibly low frequency. However, if one takes a large enough sample of particles, for example a macroscopic object, then chances are that least one of the many particles that the object consists of will undergo a random collapse over any given time interval, thus keeping the entire object from obtaining a superposition. Therefore, according to GRW, it is not at all abnormal that we do not ever observe macroscopic objects in super positions, because the probability of any given particle collapsing at a given time is just high enough that such a situation never obtains.

[12] Lower, Barry,

*Freedom from Physics: Quantum Mechanics and Free Will* (Fayetteville: University of Arkansas), *Philosophical Topics*, volume 24, n2, p 104.

[13] Note that deterministic causation is a special case of probabilistic causation where the chances of c causing e are either 1 or 0.

[14] It is presumably very unlikely that an S of such limited quantitative monitoring/interacting capacity would indeed be sufficiently complex. It seems that in some cases there does exist an overlap of the domain of the

qualitative and quantitative sufficiency conditions. Nevertheless, we cannot rule out the possibility of a sufficiently complex S without a sufficiently large domain of supervision.

[15] Though he does not go into great detail on the subject, Nozick does assert that not all decisions made by an agent must be free according to such decision operation. He posits that as long as certain life-directing decisions, which presumably would determine some other more trivial decisions, are free, then an agent's will may be said to be free.

[16] Nozick 1981: p295

[17] Nozick 1981: p300