How Quantum Mechanics is Compatible with Free Will

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The actions of almost everything in this world are causally determined by the state of the world that precedes them. Once you start a machine, if no one touches it, its behavior can be predicted entirely in advance from the laws of physics. When you drop a pen down a well, it is physically necessary that it fall.

But our behavior doesn't feel that way. When we stick out our tongue it feels as if we had to specifically choose to stick it out, that this was our own action and not a predetermined consequence of the existing state of the world.

Some people argue that because the evidence for determinism is so overwhelming, free will must simply be an illusion. But if so, it is a very odd kind of illusion. Most illusions result from a naive interpretation of our senses. For example, in a classic illusion, two drawings of equal size appear to be of different size. But when we are told this is an illusion, we can correct for it, and behave under the new (more accurate) impression that the drawings are in fact of equal size.

This simply isn't possible with free will. If someone tells you that you do not actually have free will but have actually been acting under an illusion, you cannot sit back and let determinism take over. When the waiter asks you whether you like soup or salad, you cannot say "Oh, well I've just learned that free will is an illusion and all my actions are completely determined by the previous state of the world, so I'll just let them play themselves out." I mean, you can say that, but the waiter will look at you like you're crazy and you will get neither soup nor salad.

It seems overwhelmingly bizarre that evolution would have given us this strangest of illusions. This is not a spandrel, a small place evolution never had time to be concerned about. The illusion of free will affects all aspects of our lives and takes an enormous amount of work. One would think evolution would have eliminated it were it genuinely false.

So what is the other possibility? The other possibility is that not all actions are entirely determined by the preexisting state of the world. And, in fact, recent advances in physics seem to show this is somewhat the case. Quantum mechanics suggests that at some fundamental level there is randomness involved in the laws of the world. And chaos theory shows us that small amounts of randomness in a system can have real large-scale effects.

So, although it seems extremely improbable, if we have to avoid the improbability of evolution not breeding out an illusory free will, then we're forced to look to the randomness of quantum mechanics for an explanation.

But, some argue, this is insufficient. Quantum mechanics only gives us randomness — but free will isn't just the pursuit of random behavior, it's the pursuit of particular behaviors. While quantum mechanics can't predict each individual bit, it does give overall probability distributions. Volitional behaviors would wreak havoc with those even distributions.

Not true. Imagine the simple case where we have one quantum bitstream: a series of zeroes and ones, in which each individual number cannot be predicted, but there's an overall law saying that roughly half of them will be one and half will be zero. And let us simplify the system to say that if the result of the quantum effect is 0 then the person moves left, and if it's 1 they move right. In the naive scenario, free will affects this quantum bitstream so that when the person wants to move left the randomness keeps coming up zeroes. But that would violate the laws of physics — the results would no longer be half ones and half zeroes.

So here's the trick: first, the system gets a random bit from some other source. Then it adds the bit from the other source with the bit from the quantum bitstream and uses the result to decide if you move left or right. Now, when you want to continually move left, half the time you'll have to make the quantum bitstream return zeroes and the other half the time ones — exactly what the laws of quantum mechanics require.

With a little additional mathematical complexity, the scenario is generalizable to much more complicated quantum functions and human results. But the basic principle is the same: one can use quantum randomness to exercise free will without violating any statistical laws.

Of course, this still leaves one key problem. What is picking the results of this quantum bitstream? And how does it do it? I have to admit I cannot really think of a sensible way. But this seems like a problem for neurobiology to figure out and report back to us. I merely aim to prove that its doing so is consistent with what we know about the laws of physics.