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DOES FREE WILL EXIST?

David Kyle Johnson

In 'Do Souls Exist', I suggested that, while the non-existence of the soul does threaten free will, the threat it possess is inconsequential. Free will faces so many other hurdles that, if those were overcome, the soul's non-existence would be a non-threat. In this paper, I establish this; and to do so, I define the common libertarian notion of free will, and show how neuroscience, determinism, indeterminism, theological belief, axioms in logic, and even Einstein's theory of relativity each entail that libertarian free will does not exist. I conclude by demonstrating why some philosophers reject alternate (compatibilist) understandings of free will, and so believe that the notion we are free is an illusion.

In 'Do Souls Exist' (*THINK* 35) I articulated the reasons most philosophers deny the existence of souls. (According to the infamous PhilPapers survey, only 27% of philosophers accept a soul-like non-physical view of mind.[1]) I also explored the consequences of the soul's non-existence and claimed that, although most are exaggerated, one concern seems legitimate: the non-existence of the soul threatens free will. However, I suggested, free will is threatened in so many other ways that the non-existence of the soul really isn't the problem. If we could resolve these other threats, the non-existence of the soul wouldn't really stand in the way of believing in free will. So, to see why, let me now articulate these threats and show why the majority of philosophers believe that free will, as most people conceive of it, is an illusion – and why some even reject less popular understandings of freewill that could save it.

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What is Free Will?

To avoid confusion, we must first define our terms. When asking about whether humans are free, we are not wondering about political freedom. A person's political freedom is defined by the laws that govern that person, and one is free to do an action in this sense only if that action is legal. You are not free to rob a bank, for example, in this sense of 'freedom'. You are free, however, to choose to rob a bank if you possess the kind of freedom that I am concerned about: metaphysical freedom or freedom of the will. It's a kind of ability or power that one supposedly exercises when a person chooses, of their own volition, to do an action.

How do most people conceive of metaphysical freedom? It seems that most conceive of it in (what philosophers call) the 'libertarian sense', which suggests (roughly put) that free will requires alternate possibilities. In order to freely choose to do something it must be possible for you to not choose to do that thing. There are a few reasons for thinking that this is the conception of free will that is most common among the general populace.

First of all, this view seems highly intuitive. That there are alternate possibilities seems to be the very thing that one assumes when one thinks they are making a freely willed decision. When one is making a choice about whether to do some action, one thinks that both choosing and not choosing that action is possible. If there really were only one option, no choice would be necessary – in fact, making a choice would be impossible. For example, if you are going to eat at a restaurant, but there is only one thing on the menu, you can't choose. Free will, it seems, requires alternate possibilities.

Second of all, libertarianism is conceptually tied to theism (belief in God). Theists often believe that God holds us morally responsible for what we do, and that he gives us a legitimate choice to freely choose or reject him and his teachings. It would be difficult, it seems, for God to hold us morally responsible for what we do if we couldn't have

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done otherwise. The above mentioned PhilPapers survey showed that this connection definitely holds in the philosophical community. Although only a minority of philosophers believe in God (14.6%), and an even smaller minority believe that we actually possess free will in the libertarian sense (13.7%),[2] most philosophers who are theists are also libertarians.[3] Since theism is much more common in the general population (92% in America,[4] around 65% in the UK,[5] and around 51% worldwide[6]) it's reasonable to conclude that libertarianism is as well.

Some non-libertarian philosophers claim that their view of free will – called compatibilism – is actually most common among the general populace; they often cite a study done by Eddy Nahmias (et al.) to prove this.[7] I find this unlikely and the study to be poor. At best, it shows that honors students at Florida State University are compatibilists; worse still, it contradicts a host of other studies that entail the opposite conclusion.[8] But, regardless, it's clear that the vast majority of philosophers reject the idea that we have libertarian free will and since the purpose of this paper is to explicate the reasons they have for doing so, I will now set this issue aside.

Something else that often accompanies libertarianism is the notion of agent causation – the idea that, in order for an agent (person) to freely act, they must be the cause of their action. After all, if we are free, not only must there be alternate possibilities, but which possibility is chosen must be 'up to us'. But only if an agent is the ultimate cause of their action – only if the explanation of why that choice was made ends in a decision made by that agent – can that be the case. So this, it seems, is another intuitive necessary condition of free will.

Libertarianism and agent causation have been articulated in many different ways over the years, but the nuances of these debates need not concern us here because the threats to free will that we are about to consider suggest that, no matter how you slice it, we do not have free will. As we shall now see, strong arguments suggest that no

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matter how you understand the concept of 'alternate possibilities', there are none. No matter what you think it means for your actions to be 'up to you', they are not.

The Threat of Our Neural Structure

In 'Do Souls Exist', I pointed out that one main reason philosophers doubt the existence of souls is that souls don't explain anything. We used to think that our actions were caused by decisions made in our soul that somehow reached into the physical world to make our bodies move. But neuroscience has shown us that our actions are, in truth, caused by the activity of our brains. Our brains are where our emotions are generated, our visual world is produced, where our personality is housed, where our beliefs are held, and where our decisions are made – there is nothing left for the soul to do.

But this also gives us reason to doubt the existence of free will. If our actions are the result of the activity of our brain, then what actions we take and what decisions we make, are a direct result of our brain structure – the way that our neurons are wired and fire. But that means, only if we have control of the way our neurons are wired and fire can we be free. Unfortunately, we do not. Much of our neural configuration is simply the result of genetics; our DNA dictates that our brain has certain structures set up in certain ways – and clearly we have no control over our genetics. The rest of your brain structure is determined by external stimuli, what is often called your 'environment'. What you have experienced throughout your life – the things you have learned, the events you have seen, and the words you have heard – have caused your neurons to wire and fire in certain ways – and you've had no control over that either.

You may think that you do have control over your environment; after all, you can choose to expose yourself to certain stimuli and to avoid others. But those choices themselves are dictated by your brain structure, which again is a

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result of your genetics and your previous environments. You may have chosen them, but that choice too was a result of your brain structure, which was a result of your genetics and previous environment. Just keep tracking it back and eventually you get to stimuli which you had no control over – like those in your childhood environment.

So, ultimately, the way your brain is wired and fires is not up to you. And since your brain's structure dictates your conscious decisions, it seems you don't have free will. But perhaps the part of your brain responsible for conscious decision making – which we now know is the prefrontal cortex[9] – is so complex that it somehow gives rise to free will in some mysterious way.

Unfortunately, neuroscience has deflated the balloon of that notion too. It turns out that the parts of our brain responsible for producing conscious decisions – what we usually take to be the cause of our actions – are not actually responsible for our actions at all. Research suggests that our actions are the product of unconscious activities in our brains. The fact that a decision has been made is fed to the prefrontal cortex only after unconscious parts of our brains are done with the decision making; and only then – again, after the decision is already made – does the cortex give rise to the conscious experience of 'making a decision'.

Of course, we assume that the conscious decision is what caused our action because it was correlated with it and we are apt to assume that correlation entails causation. But of course, it does not. That is a classic logical fallacy that our brains find convincing. So, it's almost as if our brain is wired to fool us into thinking that we have free will when we don't. It makes decisions unconsciously but then, after the fact, generates an experience of making a decision and then fools itself into believing that it was the conscious decision that did all the causal work. (Perhaps that way of making sense of the world is more comforting.)

What evidence is there that unconscious parts of our brains do the decision making? Plenty. It began in the 1960s when the neuroscientists Hans Helmut Kornhuber

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and Lüder Deecke discovered what they called a 'readiness potential'. They measured the brain activity before a decision occurred to see the processes that led to the decision being made. It turned out, those processes happened before a decision was consciously made and did not occur in the part of the brain responsible for the generation of conscious decisions.

Of course, that's just one study – but since then, their findings have been repeated, supported, and reiterated in many ways. In the 1980s, Benjamin Libet showed that the readiness potential occurs at least 0.35 seconds before a decision is consciously made. In 2008, psychologist John-Dylan Haynes measured the brain activity before the decision to push a button was made and found it to be much sooner. Neuroscientist Itzhak Fried did a similar experiment where he observed neurons more directly, and was not only able to see the brain unconsciously deciding what to do before the conscious decision, but was even able to predict the conscious decision before it was made with 80–90% accuracy.[10]

This is truly astonishing. In no way can our actions be up to us if the decisions to perform those actions originate in parts of our brains that are unconscious – parts of our brains that we have no control over. These parts of our brains have nothing to do with the production of the 'conscious decisions' that we believe cause our actions and make them free. And if our actions are not up to us, then we are not free.

Of course, these studies reveal only that the decisions being studied (like deciding which button to push, or which finger to move) originate in unconscious parts of the brain. Perhaps more grandiose decisions about life and everyday actions don't; perhaps those decisions are made by the conscious prefrontal cortex. In addition, some people don't find the studies convincing and suggest that they don't necessarily negate free will. Or better yet, maybe only the wiring of our brain is out of our control; maybe how our neurons fire (even in unconscious parts of our brain) are somehow up to

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us. That's possible I suppose; of course, the fact that something is possible is not a reason to think that it's true – but it's still possible. (I am only trying to explicate why many philosophers doubt the existence of free will, after all.) Unfortunately, even if these studies don't negate free will, there is an even deeper threat to free will – that lies on even more solid scientific grounds – that negates even these glimpses of hope.

The Threat of Determinism and Randomness

To understand why many philosophers believe that the activity of all parts of our brain (and thus ultimately our actions) are not up to us, we must first understand what a deterministic system is. To understand that, imagine a billiard table the moment after the cue ball has been hit toward a racked set of balls at the other end. If you knew all the physical facts, and all the physical laws – and you were really fast at math – you could predict the final resting place of every ball on the table and the path that each would take to get there.

The billiard table is a 'deterministic system'. Everything that happens in it is directly caused by what happened in it the moment before; what happens in it is in principle predictable and determined ultimately by its initial state and the physical laws. If you were to set it up and start it again – 'rewind it' if you will – just like you did before, the exact same things would happen again. In such a system, not only does no ball have any choice regarding where it will end up, or how it will get there, but nothing could happen in that system except what was determined to happen once the cue ball was hit.

What many scientists thought for a long time was that our universe is like a 3-dimensional billiard table, with particles (e.g., atoms) for billiard balls and space itself as the table on which they move. Everything that happens in the universe is dictated by its initial condition and the laws of

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physics. Nothing can happen except what has been determined to happen since the beginning of time. And since our brains are a part of that universe – our brains are made up of those particles – this is true of them as well. Everything that happens in our brain is ultimately just the motion of particles, but every motion of a particle can be explained by the motion of particles during the previous moment – and those by the motions of particles during the previous moment, etc., etc. – all the way back to the beginning of the universe.

Clearly, if this is the case, we have no (libertarian) free will. Not only are there no alternate possibilities – nothing can happen but what has been determined to happen since the dawn of time – but no person is the ultimate cause of their actions. Not only can we do nothing about the deterministic causal interaction going on between the particles in our brains, but the ultimate cause of all events lies at the beginning of the universe. All causal explanations bottom out there. I did what I did because such-and-such happened in my brain, but that happened in my brain (ultimately) because events at the beginning of time determined that it would. Clearly, determinism is not compatible with libertarian free will.

There is some good news, however. Science has long since disproven the idea that our universe is a deterministic system. Arguably the most confirmed scientific theory in history, quantum mechanics, shows us that not all events in the universe are determined by previous events and the physical laws. Some things that quantum particles do – particles smaller than atoms – happen at random and without a cause.

Let me be clear: It's not that we can't detect the cause of such events; we have proven that there is no cause. In fact, we have proven that there cannot be a cause of such events. For example, the decay of a radioactive atom has no cause and happens at random. You can lay down probabilities about how likely an atom is to decay during a certain interval, but when it decays, it will decay at random

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and without a cause. 'Rewind' the universe and that same atom will very likely decay at a different time.

But the bad news is, this does not save free will. Yes, uncaused randomness does not allow a complete causal chain that tracks back to the beginning of the universe. It also allows for more than one possible future. But randomness is not any more compatible with free will than determinism. To see why, imagine that I am choosing between two options. As we already know, what I will choose is determined by the activity of my brain; but let's assume that the outcome of that activity is genuinely random because of quantum mechanics. Imagine, for example, that what decision the activity of my brain will generate is dictated by the outcome of a single random quantum event. If some atom in my brain decays I chose X, and if it doesn't I choose Y. Clearly, there are alternate possibilities in this scenario. But am I free? No, because the outcome of a quantum event is in no way up to me. Not only do I not have the ability to dictate such an outcome, but it's not possible to do so. Again, we know that quantum events are random and uncaused; if I dictated the outcome of a quantum event, it would be neither. And so, even though determinism is in the strictest sense false, we still are not free; the reason determinism is false does nothing to rescue free will. Indeterminism is just as incompatible with free will as determinism.

Worse still, even though quantum mechanics has falsified determinism in the strictest sense, determinism may still be true in a loser sense that restricts free will. Even though what happens on the quantum level is random, quantum randomness gets 'averaged out' on a larger scale. Although it's not possible to predict the behavior of individual quantum particles, it is possible to predict how large groups of them will behave. (For example, if you have 100 radioactive atoms, you know that 50 of them will decay during the next half-life, even though you don't know which ones will.) And your brain is a large group of quantum particles. So most likely the activity of your brain is still deterministic – and consequently, you are not free.

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But as if that was not enough, the threat to free will goes even deeper. It goes beyond the fact that we have no control over our brain's neural configuration, beyond the fact that our decisions are made unconsciously, and even beyond the fact that our brain is a physical organ the behavior of which is either determined or random. The very structure of space and time itself also seems to make our possession of free will impossible.

The Threat of the Block Universe

Imagine a universe in which all the moments in the history of that universe are laid out like the frames of a movie reel – all laid end to end, in temporal order, in a kind of strip. (Let's call this a 'strip universe'.) Imagine that strip is fed through a device (a projector) that makes each moment 'occur' one at a time. After it starts, the ones that have already been projected are the past, the one being projected is the present, and the ones that will be projected are the future. Notice that, before this strip universe is fed through its projector, what will happen in that universe is already decided. Just like a movie, the beginning, middle, and ending are already written. Even though as you watch the moments being displayed you don't *know* what will happen, there is only one possible ending – only one possible set of events that will follow the present moment. The future is already laid out.

So suppose you are watching someone in that universe make a decision – a choice, say, between eating pizza or eating a sandwich. Will that person's choice be free? Well, ask yourself – is there a real alternate possibility? Of course, you don't know what they will choose – but are both options genuinely within the person's grasp? No, because the event of their choice is already written on the strip. The moment that contains the event of their choice already exists on the strip; we are just moving closer to it as the projector makes the events before it occur. No other thing but that which is

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already written on the strip is possible. So, even though we don't know what choice the person will make, we know that the choice that person will make isn't free because we know that there is no alternate possibility.

Now, of course, the person making the choice might not know this; they may think that both the pizza and the sandwich are a genuine possibility. In fact, if they really think they are choosing, they must think this. But what is required for free will is not that the person choosing *thinks* there are alternate possibilities, but that there *actually are* alternate possibilities. And since, in a strip universe, every moment of the universe exists before it occurs, in this scenario there are not alternate possibilities and thus this person does not have free will.

As you might have guessed, the final threat to free will we are considering suggests that our universe is like a strip universe. Those who embrace this view often call it a 'block universe', instead of a 'strip universe', but the concept is essentially the same. They suggest that our universe is a set of three dimensional time slices – moments in time – collected together, in temporal order, in a four dimensional block. Everything that has happened, is happening, or will happen is laid out in the block, and what we experience as the passage of time is merely the occurrence of these moments in temporal order.[11]

What reasons are there to think that we live in a block universe? Quite a few.

Belief in the existence of a perfectly knowledgeable being, such as God, seems to commit one to this view. Such a being presumably now knows the future, but how is that possible unless the future already exists to be known? How can such a being now know what the future holds unless the future exists to hold something? Alternately, many suggest that God doesn't know anything 'now' but instead exists a-temporally – outside of the timeline – and sees all of time (past, present and future) as a whole. But this is not possible unless all of time (past, present and future) exist as a whole – that is, unless we live in a block

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universe. So, once again, God's foreknowledge seems to entail a view of time that is incompatible with free will. In short, no matter how he does it, if God knows the future, then the future is already written, and if it's already written, we can't be free.

But even if you don't believe in God, the threat of a block universe still exists because it follows from the basic axioms of logic. All propositions have a truth value; every proposition is either true or false. This includes propositions about the future, like statements about our future choices. If you will choose to do X, it is true right now that you will. (And if you won't, it is true right now that you won't.) But what could make such propositions true unless it is the future events to which those propositions refer? And how can future events make a proposition about the future true unless that future event is real – unless those future events already exist 'on the block'.

Think of it this way. Propositions do not have the truth value they do for no reason. Propositions attain their truth value in virtue of their correspondence to the world. If a proposition corresponds to the world, it is true; if it does not, it is false. But what part of the world could a proposition about the future correspond to – especially a proposition about a future choice that one will make – unless it is the future event of that choice being made?[12] Further, how can a proposition that is true right now correspond to a future event unless that future event already exists – unless it is now a part of the universe? Of course, it's not occurring right now, but it must exist if it is to be a part of the universe so that it can serve as a truthmaker for the proposition in question. And the only way it seems that can be the case is if the future is already written – if we live in a block universe.

To preserve their belief in free will, some have tried to avoid being committed to believing that we live in a block universe. This is done in various ways. Open theists suggest that God doesn't know the future, so it need not exist to be known. Some logicians suggest that many propositions about future events, like those about our choices,

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do not have a truth value until the event in question occurs. These moves are highly debatable and they require us to reject many traditional concepts about God and logic. Still others simply try to argue that God's foreknowledge or the axioms of logic don't commit us to the idea that we live in a block universe.[13] I personally don't think such arguments work, but even if they do, they still do not allow one to avoid the threat the block universe poses to free will. Why? Because one of the most well founded theories in all of science also entails that we live in a block universe: Einstein's theory of relativity.

Unfortunately, I don't have the space to explain relativity here, or why it is universally accepted by scientists,[14] but I can sketch a basic picture regarding why it entails that we live in a block universe. Let me begin with the fact that one of the many things relativity says is relative is simultaneity – whether two events happen 'at the same time'. If two events (A and B) are simultaneous in one reference frame, there will be another reference frame in which they are not. In one such frame, A happens before B, and in another B before A.

Now some events are 'spacetime separated' in such a way that there is no reference frame in which they are simultaneous. For example, there is no reference frame in which some choice you will make tomorrow is simultaneous with what you are doing now. However, there is another event in the universe that is simultaneous with both; in one reference frame that event (call it E) is simultaneous with what you are doing now, in another reference frame E is simultaneous with the choice you will make tomorrow.

Why does this commit us to believing we live in a block universe? Because, unlike simultaneity, co-existence is not relative to reference frame. Instead, it is a transitive property. If your current action is simultaneous in one reference frame with some event E, then your current action and E co-exist. Two things can't happen at the same time unless they both exist together. But E is also simultaneous with your future action in another reference frame; so E and your future action also co-exist. But if your current action

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co-exists with E, and E co-exists with your future action, then your current action co-exists with your future action.[15] They don't *occur* at the same time, of course, but occurrence is not the same thing as existence. In the same way that the frames of a film all exist together, even while one is being shown and the others aren't, your present action and your future action *exist* together even though only one occurs at a time.

This kind of co-existent connection can actually be drawn between any two events in the entire history of the universe.[16] So the way scientists describe the nature of the universe, given relativity, is as a giant collection of spacetime events that exist all together in a giant block. Some relations between these events, like their simultaneity, are relative to reference frame; other properties, like their spacetime relation, are not.[17] But they all exist together in the block.

So unless relativity is overturned, it's seems impossible to maintain that the future does not already exist. And if it does already exist, there is only one possible future. But if only one future is possible, we cannot have free will – at least not in the libertarian sense.

And even if we resolve this problem, we still have the problems posed by determinism, quantum indeterminacy and the discoveries of neuroscience. Hopefully, by now, you can see why the non-existence of the soul really isn't something to worry about when it comes to free will. If one could demonstrate that we still have free will, despite the fact that we live in a indeterministic block universe in which our actions are solely dictated by activity of the unconscious parts of our brain – how could the non-existence of the soul even be relevant?

Dealing with Compatiblism

The primary aim of this paper was to lay out the reasons that the majority of philosophers doubt the existence of free will as it is most commonly conceived – that is, in the

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libertarian sense. I have not addressed the arguments of philosophers who suggest that the libertarian conception of free will is inadequate and that, on the correct understanding, we indeed do have free will. The most common suggestion among such philosophers, called compatibilists, is that as long as a person's action is derived from some part of them (such as their higher order desires or a deliberative reasoning process) then that action is free. And since this can be true even if my actions derive from unconscious parts of my brain – or if determinism is true, or if we live in a block universe, or if there are no souls – they don't think such things are a threat to free will.

According to the aforementioned PhilPapers survey, a majority of philosophers accept or lean towards compatibilism (59.1%). Only a small minority rejects the idea of free will altogether (12.2%). These philosophers, it seems, accept the libertarian understanding of free will, but also accept that the threats it faces are insurmountable. So let me close by articulating one last defense of the idea that free will is an illusion by articulating why this minority group rejects compatibilism.

On compatiblism, what makes you free is that your actions are generated by some part of you – like your higher order desires. If it turns out that the fact that you would have those desires, and that you would act on them, is completely out of your control, it doesn't matter. According to the compatibilist, even if you were determined to have those desires since the beginning of the universe (or were programmed to have them by your genes and environment) you are still free.

But for the minority of philosophers who reject compatiblism, this is just too big a bullet to bite; if we are truly free, our actions can't *ultimately* be the result of outside causes. If I were to program an android to desire beyond all else to rob a bank and give me all the money, I would not be able to avoid jail time by just handing the money back and saying that the robot freely chose to rob the bank because it was acting in accordance with its desires. Whatever is

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the *ultimate* cause of the action is responsible for the action; yet according to compatibilists, that's not us.

In addition, this minority of philosophers is unconvinced by compatibilist arguments against the libertarian understanding of free will. The most famous such argument is a thought experiment in which a person freely chooses to do something even though 'choosing otherwise' is impossible. The philosopher Harry Frankfurt imagines a situation in which a person has a mechanism in their brain that will force that person to choose X if they are about to choose otherwise, but the mechanism never activates because the person chooses X on their own. He suggests that this proves libertarianism false because it's a situation in which it's possible to act freely even when there are not alternate possibilities.

Philosophers in this minority can insist that, while it is true that in such examples the person is free even though they can't 'choose otherwise', it is not the case that such examples falsify the most well thought out articulations of libertarianism. Notice, for example, that no such thought experiment could falsify the version of libertarianism I articulated at the beginning of this paper which suggested: *in order to freely choose to do something it must be possible for you to not choose to do that thing.* In Frankfurt-style counter examples, it is always possible for the person in question to *not choose* to do X because it is possible for the machine to choose for them. Thus this minority remains convinced that the libertarian conception of free will is accurate, even though they are also convinced that we do not possess such free will.

I began by laying out the reasons the majority of philosophers reject the idea that we possess libertarian free will – a notion that, I argued, is likely the majority view among the general public. We saw it faces three major threats. I ended with a defense of why a minority of philosophers think that we do not possess free will, even in the compatibilist sense. My intention was not to convince any philosophers that their view was right or wrong, but I hope that the

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reader now has a better understanding of who believes what, and why, when it comes to free will.

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Notes

[1] D. Bourget & D. Chalmers, 'What do Philosophers Believe?', *Philosophical Studies* (2013), 1–36. http://philpapers.org/surveys/results.pl

[2] Although, it should be noted, believing that we don't have libertarian free will is not the same thing as believing that the libertarian 'definition' of free will is incorrect. One may think that alternate possibilities are required if we are to be free, but simply believe that there are not alternate possibilities. I will discuss this further.

[3] D. Bourget & D. Chalmers, 'What do Philosophers Believe?', *Philosophical Studies* (2013), 1–36. http://philpapers.org/surveys/linear_most.pl

[4] F. Newport, 'More Than 9 in 10 Americans Continue to Believe in God', Gallup.com (2011). http://www.gallup.com/poll/147887/americans-continue-believe-god.aspx

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[7] E. Nahmias, S. Morris, T. Nadelhoffer, and J. Turner, 'Surveying freedom: Folk intuitions about free will and moral responsibility', *Philosophical Psychology*, no. 18 (2006), 561–584.

[8] For a nice rundown of this literature, see J.A. Coyne's 'Does the average person believe in determinism, free will, and moral responsibility' on the *Why Evolution Is True* blog at http://whyevolutionistrue.wordpress.com/2014/02/19/does-the-average-person-believe-in-determinism-free-will-and-moral-responsibility/

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[9] F. Manes, B. Sahakian, L. Clark, R. Rogers, N. Antoun, M. Aitken and T. Robbins, 'Decision-making processes following damage to the prefrontal cortex', *Brain*, vol. 125, no. 3 (2002), 624–639. http://brain.oxfordjournals.org/content/125/3/624.long

[10] For a rundown of this literature, including links to the original research, see Dvorsky, George, 'Scientific evidence that you probably don't have free will', io9.com (2013). http://io9.com/5975778/scientific-evidence-that-you-probably-dont-have-free-will

[11] In fact, some suggest that the passage of time (and the notion of a past, present and future) is an illusion; all moments in the block have equal status in all respects. No one moment in time is occurring, while others are past and others are future. All that exists is a relationship between such moments such that, for every moment in time, certain moments are past (relative to it) and certain moments are future (relative to it). But such destinations need not concern us because they don't matter for the threat to free will that this view poses.

[12] If a future event is determined by present physical facts to occur, one could find a truthmaker for it in the present. But, as we have already seen, future human actions cannot be determined to occur by present facts if they are going to be free.

[13] For more on these arguments, see D.K. Johnson, 'God, fatalism and Temporal Ontology', *Religious Studies*, vol. 45, no. 4 (2009), 435–454.

[14] For such explanations, see the lectures on relativity in my course for 'The Great Courses', *Exploring Metaphysics*. http://www.thegreatcourses.com/tgc/courses/course_detail.aspx?cid=4182

[15] This follows from a basic rule of transitivity. If A co-exists with B, and B with C, then A co-exists with C.

[16] In some cases it will involve drawing connections between many events, but a co-existence relation between any two spacetime events can be demonstrated.

[17] This makes the Einsteinian Block World slight different than the one describe above; since simultaneity is relative, and there is no preferred reference frame, you can't have 'three dimensional time slices – moments in time – collected together, in temporal order.' The Einsteinian Block World is just a collection of spacetime related events and different reference frames will entail different ways to divide those events into 'moments in time' (i.e., into events that happen simultaneously). But the general idea is the same. Both kinds of block worlds are incompatible with free will, and for the same reason.

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