Brian Koberlein
"Photons, Quasars and the Possibility of Free Will" (2018)

Flickers of light from the edge of the cosmos help physicists advance the idea that the future is not predetermined.

Life is full of choices. Do we have a cookie or go to the gym? Do we binge watch our favorite show on Netflix or go to bed at a reasonable time? Our choices have consequences, and we make them of our own free will. Or do we? The nature of free will has long inspired philosophical debates, but it also raises a central question about the fundamental nature of the universe. Is the cosmos governed by strict physical laws that determine its fate from the big bang until the end of time? Or do the laws of nature sometimes allow for things to happen at random? A century-old series of physics experiments still hasn't been able to settle the question, but a new experiment has tilted the odds toward the latter by performing a quantum experiment across billions of light-years.

The laws of classical physics are deterministic. Newton's mathematical cosmos is a clockwork universe, where each cause has a unique effect and we are governed not by our choices but by the rigid laws of nature. Quantum physics, on the other hand, has a property of fuzzy randomness, which some scientists feel could open the door to free will. Because quantum physics lies at the heart of reality, it would seem that randomness wins the day.

Yet some scientists have argued that quantum randomness isn't truly random. If I roll a die, the outcome seems random, but it isn't really. All of its bumps and turns are caused by the forces of gravity and the table in a complex dance, but that dance is deterministic. The moment the die leaves my hand, its fate is sealed, even though I don't know the outcome until it happens. Perhaps quantum objects behave in the same way. Although they seem to act in random ways, they are really governed by some deterministic hidden variables.

It is a question that has fascinated me since graduate school. My dissertation focused on aspects of quantum gravity, a subject that we still don't fully understand. One of the reasons for this is that we don't know how Einstein's deterministic theory of gravity can fit together with the randomness of quantum mechanics.

The question fascinated Einstein as well, and being much smarter than I, he came up with an experiment that could test the idea. Together with Boris Podolsky and Nathan Rosen, both then at the Institute for Advanced Study in Princeton, N.J., he presented a thought experiment now known as the Einstein-Podolsky-Rosen experiment, or EPR experiment for short.

To understand the experiment, suppose we have a mischievous mutual friend named Jane. Whenever Jane wears out a pair of running shoes, she loves to prank us by sending one shoe to each of us. So, whenever you get a shoe in the mail from Jane, you know I've gotten one, too. One of us gets the right shoe, the other the left. But until either of us opens our respective box, neither of us knows which shoe we have. Once the box arrives at your door, you open it up and find you have the left shoe. At that moment, you know I must have the right shoe.

This is the basic idea of the EPR experiment. It's nothing more than a silly prank in our everyday world, but for quantum objects it gets really strange. You may have heard of Schrödinger's cat, where a quantum cat is neither alive nor dead until observed in a definite state. Like classical cats, quantum cats like quantum boxes. In the quantum realm, things can be in an indefinite state until you observe them. It would be as if our boxes contained a pair of something (gloves, shoes, salt and pepper shakers, etcetera), but it is impossible to know what specific something until one of us opens their box. Even stranger, how we measure quantum objects determines what the outcome can be. It would be as if opening the box on the side forces it to be a glove, while opening it from the top forces it to be a shoe. How I open my box affects your box miles away. In quantum theory, we say that our two boxes are entangled, so that observing the content of one box also tells us something about the other.

We can't do this experiment for gloves and shoes, but we can do it with light. Two entangled photons can be sent in opposite directions. I measure the orientation of one photon at random, you measure the other, and then we compare our results. There are lots of different orientations we would measure, so we can each choose the orientation we want. When this experiment is done in the laboratory, it actually works. And if our measurements are random, there is no way for the photons to know ahead of time which orientation will be measured. So, there can't be any hidden variable to determine the outcome. Whether we get the left or right shoe or the left or right glove, the result is truly random.

This is the heart of why Einstein referred to entanglement as "spooky action at a distance." It's spooky because entangled objects have a quantum connection, even if they are light-years apart. So, a measurement on one object is a measurement on both through this spooky entanglement. But it's only spooky if the measurement we make is random. If it's not random, then no spooky connection is necessary to explain the EPR results.

This is known as the "freedom of choice" loophole. EPR experiments are done in a lab, and even though the choice of how to measure the photons seems random, if there's no free will, then the observation we make was determined by earlier conditions. Because it takes time to set up the experiment in a lab, it's possible that there are small interactions that could let the quantum system know ahead of time what measurement will be done. Maybe the experiment, the scientists and the lab are all entangled in such a way that the outcome isn't truly random, so the quantum objects can game the outcome.

To get around the loophole, you have to deal with the speed of light. It's often said that nothing can travel faster than the speed of light, but it's really information that can't travel faster than light. We can send each other telegrams or text messages, but never faster than the time it takes for light to travel between us. In a small lab, light has plenty of time to travel back and forth across the room while the experiment is being set up, so perhaps small bits of information bias the "random" aspect of experiment before it's even done. That doesn't seem very likely, but a new experiment has overcome this problem. Rather than using a random-number generator in the lab to decide which photon measurement to make, the experimenters used quasars.

Quasars are brilliant beacons of light powered by supermassive black holes in the centers of distant galaxies. The team used random fluctuations in the light from quasars to determine how the photons were measured. Because the light from a quasar has to travel for billions of years to reach us, the fluctuations in brightness happened billions of years before the experiment was done—billions of years before humans even walked the earth. So, there is absolutely no way for it to be entangled with the experiment.

The result was just what quantum theory predicts. Thus, it looks like there really are no deterministic hidden variables, and randomness is still possible throughout the cosmos.

Of course, randomness isn't the only thing necessary for free will. But it does mean that your fate is not necessarily sealed. So, when you resist that second cookie or turn off the TV in the evening, you can take pride in the fact that maybe, just maybe, the choice was yours after all.

Association of Psychological Science
“Destined to Cheat? New Research Finds Free Will Can Keep us Honest” (January 28, 2008)

With the start of the New Year millions of Americans have resolved to lie less, cheat less, put the holiday hangovers behind them, or otherwise better their lives. Some will moderate their bad habits; others may make significant changes and become shining examples of integrity. But most of those well-intended New Year’s resolutions are destined to fail. In an age where cheating scandals plague elite universities and major corporations are brought down by unethical actions, the debate about the origins and nature of our decisions play into a larger debate about genetic determinism and free will.

It is well established that changing people’s sense of responsibility can change their behavior. But what would happen if people came to believe that their behavior was the inevitable product of a causal chain beyond their control – a predetermined fate beyond the reach of free will?

Surprisingly, the link between fatalistic beliefs and unethical behavior has never been examined scientifically—until now. In two recent experiments, psychologists Kathleen Vohs of the University of Minnesota and Jonathan Schooler of the University of British Columbia decided to explore this knotty philosophical issue in the lab, and they figured out an innovative way to do it.

Vohs and Schooler set out to see if otherwise honest people would cheat and lie if their beliefs in free will were manipulated.

The psychologists gave college students a mathematics exam. The math problems appeared on a computer screen, and the subjects were told that a computer glitch would cause the answers to appear on the screen as well. To prevent the answers from showing up, the students had to hit the space bar as soon as the problems appeared.

In fact, the scientists were observing to see if the participants surreptitiously used the answers instead of solving the problems honestly on their own. Prior to the math test, Vohs and Schooler used a well-established method to prime the subjects’ beliefs regarding free will: some of the students were taught that science disproves the notion of free will and that the illusion of free will was a mere artifact of the brain’s biochemistry whereas others got no such indoctrination.

The results were clear: those with weaker convictions about their power to control their own destiny were more apt to cheat when given the opportunity as compared to those whose beliefs about controlling their own lives were left untouched.

Vohs and Schooler then went a step further to see if they could get people to cheat with unmistakable intention and effort. In a second study, the experimenters set up a different deception: they had the subjects take a very difficult cognitive test. Then, the subjects solved a series of problems without supervision and scored themselves. They also “rewarded” themselves $1 for each correct answer; in order to collect, they had to walk across the room and help themselves to money in a manila envelope.

The psychologists had previously primed the participants to have their beliefs in free will bolstered or reduced by having them read statements supporting a deterministic stance of human behavior. And the results were just as robust. As reported in the January issue of *Psychological Science*, a journal of the Association for Psychological Science, this study shows that those with a stronger belief in their own free will were less apt to steal money than were those with a weakened belief.

Although the results of this study point to a significant value in believing that free will exists, it clearly raises some significant societal questions about personal beliefs and personal behavior.

Bahar Gholipour
"A Famous Argument Against Free Will Has Been Debunked" (September 10, 2019 in *Atlantic Magazine*)

The death of free will began with thousands of finger taps. In 1964, two German scientists monitored the electrical activity of a dozen people's brains. Each day for several months, volunteers came into the scientists' lab at the University of Freiburg to get wires fixed to their scalp from a showerhead-like contraption overhead. The participants sat in a chair, tucked neatly in a metal tollbooth, with only one task: to flex a finger on their right hand at whatever irregular intervals pleased them, over and over, up to 500 times a visit.

The purpose of this experiment was to search for signals in the participants' brains that preceded each finger tap. At the time, researchers knew how to measure brain activity that occurred in response to events out in the world—when a person hears a song, for instance, or looks at a photograph—but no one had figured out how to isolate the signs of someone's brain actually initiating an action.

The experiment's results came in squiggly, dotted lines, a representation of changing brain waves. In the milliseconds leading up to the finger taps, the lines showed an almost undetectably faint uptick: a wave that rose for about a second, like a drumroll of firing neurons, then ended in an abrupt crash. This flurry of neuronal activity, which the scientists called the *Bereitschaftspotential*, or readiness potential, was like a gift of infinitesimal time travel. For the first time, they could see the brain readying itself to create a voluntary movement.

This momentous discovery was the beginning of a lot of trouble in neuroscience. Twenty years later, the American physiologist Benjamin Libet used the *Bereitschaftspotential* to make the case not only that the brain shows signs of a decision before a person acts, but that, incredibly, the brain's wheels start turning before the person even consciously intends to do something. Suddenly, people's choices—even a basic finger tap—appeared to be determined by something outside of their own perceived volition.

As a philosophical question, whether humans have control over their own actions had been fought over for centuries before Libet walked into a lab. But Libet introduced a genuine neurological argument against free will. His finding set off a new surge of debate in science and philosophy circles. And over time, the implications have been spun into cultural lore.

Today, the notion that our brains make choices before we are even aware of them will now pop up in cocktail-party conversation or in a review of *Black Mirror*. It's covered by mainstream journalism outlets, including *This American Life*, *Radiolab*, and this magazine. Libet's work is frequently brought up by popular intellectuals such as Sam Harris and Yuval Noah Harari to argue that science has proved humans are not the authors of their actions.

It would be quite an achievement for a brain signal 100 times smaller than major brain waves to solve the problem of free will. But the story of the *Bereitschaftspotential* has one more twist: It might be something else entirely.

The *Bereitschaftspotential* was never meant to get entangled in free-will debates. If anything, it was pursued to show that the brain has a will of sorts. The two German scientists who discovered it, a young neurologist named Hans Helmut Kornhuber and his doctoral student Lüder Deecke, had grown frustrated with their era's scientific approach to the brain as a passive machine that merely produces thoughts and actions in response to the outside world. Over lunch in 1964, the pair decided that they would figure out how the brain works to spontaneously generate an action. "Kornhuber and I believed in free will," says Deecke, who is now 81 and lives in Vienna.

To pull off their experiment, the duo had to come up with tricks to circumvent limited technology. They had a state-of-the-art computer to measure their participants' brain waves, but it worked only after it detected a finger tap. So to collect data on what happened in the brain beforehand, the two researchers realized that they could record their participants' brain activity separately on tape, then play the reels backwards into the computer. This inventive technique, dubbed "reverse-averaging," revealed the *Bereitschaftspotential*.

Images from the 1964 experiment show the *Bereitschaftspotential* (left) and one of the finger-tapping subjects. *(Lüder Deecke)*

The discovery garnered widespread attention. The Nobel laureate John Eccles and the prominent philosopher of science Karl Popper compared the study's ingenuity to Galileo's use of sliding balls for uncovering the laws of motion of the universe. With a handful of electrodes and a tape recorder, Kornhuber and Deecke had begun to do the same for the brain.

What the *Bereitschaftspotential* actually meant, however, was anyone's guess. Its rising pattern appeared to reflect the dominoes of neural activity falling one by one on a track toward a person doing something. Scientists explained the *Bereitschaftspotential* as the electrophysiological sign of planning and initiating an action. Baked into that idea was the implicit assumption that the *Bereitschaftspotential* causes that action. The assumption was so natural, in fact, no one second-guessed it—or tested it.

Libet, a researcher at the University of California at San Francisco, questioned the *Bereitschaftspotential* in a different way. Why does it take half a second or so between deciding to tap a finger and actually doing it? He repeated Kornhuber and Deecke's experiment, but asked his participants to watch a clocklike apparatus so that they could remember the moment they made a decision. The results showed that while the *Bereitschaftspotential* started to rise about 500 milliseconds before the participants performed an action, they reported their decision to take that action only about 150 milliseconds beforehand. "The brain evidently 'decides' to initiate the act" before a person is even aware that decision has taken place, Libet concluded.

To many scientists, it seemed implausible that our conscious awareness of a decision is only an illusory afterthought. Researchers questioned Libet's experimental design, including the precision of the tools used to measure brain waves and the accuracy with which people could actually recall their decision time. But flaws were hard to pin down. And Libet, who died in 2007, had as many defenders as critics. In the decades since his experiment, study after study has replicated his finding using more modern technology such as fMRI.

But one aspect of Libet's results sneaked by largely unchallenged: the possibility that what he was seeing was accurate, but that his conclusions were based on an unsound premise. What if the *Bereitschaftspotential* didn't cause actions in the first place? A few notable studies did suggest this, but they failed to provide any clue to what the *Bereitschaftspotential* could be instead. To dismantle such a powerful idea, someone had to offer a real alternative.

In 2010, Aaron Schurger had an epiphany. As a researcher at the National Institute of Health and Medical Research in Paris, Schurger studied fluctuations in neuronal activity, the churning hum in the brain that emerges from the spontaneous flickering of hundreds of thousands of interconnected neurons. This ongoing electrophysiological noise rises and falls in slow tides, like the surface of the ocean—or, for that matter, like anything that results from many moving parts. "Just about every natural phenomenon that I can think of behaves this way. For example, the stock market's financial time series or the weather," Schurger says.

From a bird's-eye view, all these cases of noisy data look like any other noise, devoid of pattern. But it occurred to Schurger that if someone lined them up by their peaks (thunderstorms, market records) and reverse-averaged them in the manner of Kornhuber and Deecke's innovative approach, the results' visual representations would look like climbing trends (intensifying weather, rising stocks). There would be no *purpose* behind these apparent trends—no prior plan to cause a storm or bolster the market. Really, the pattern would simply reflect how various factors had happened to coincide.

"I thought, *Wait a minute*," Schurger says. If he applied the same method to the spontaneous brain noise he studied, what shape would he get? "I looked at my screen, and I saw something that looked like the *Bereitschaftspotential*." Perhaps, Schurger realized, the *Bereitschaftspotential*'s rising pattern wasn't a mark of a brain's brewing intention at all, but something much more circumstantial.

Two years later, Schurger and his colleagues Jacobo Sitt and Stanislas Dehaene proposed an explanation. Neuroscientists know that for people to make any type of decision, our neurons need to gather evidence for each option. The decision is reached when one group of neurons accumulates evidence past a certain threshold. Sometimes, this evidence comes from sensory information from the outside world: If you're watching snow fall, your brain will weigh the number of falling snowflakes against the few caught in the wind, and quickly settle on the fact that the snow is moving downward.

But Libet's experiment, Schurger pointed out, provided its subjects with no such external cues. To decide when to tap their fingers, the participants simply acted whenever the moment struck them. Those spontaneous moments, Schurger reasoned, must have coincided with the haphazard ebb and flow of the participants' brain activity. They would have been more likely to tap their fingers when their motor system happened to be closer to a threshold for movement initiation.

This would not imply, as Libet had thought, that people's brains "decide" to move their fingers before they know it. Hardly. Rather, it would mean that the noisy activity in people's brains sometimes happens to tip the scale if there's nothing else to base a choice on, saving us from endless indecision when faced with an arbitrary task. The *Bereitschaftspotential* would be the rising part of the brain fluctuations that tend to coincide with the decisions. This is a highly specific situation, not a general case for all, or even many, choices.

Other recent studies support the idea of the *Bereitschaftspotential* as a symmetry-breaking signal. In a study of monkeys tasked with choosing between two equal options, a separate team of researchers saw that a monkey's upcoming choice correlated with its intrinsic brain activity before the monkey was even presented with options.

In a new study under review for publication in the *Proceedings of the National Academy of Sciences*, Schurger and two Princeton researchers repeated a version of Libet's experiment. To avoid unintentionally cherry-picking brain noise, they included a control condition in which people didn't move at all. An artificial-intelligence classifier allowed them to find at what point brain activity in the two conditions diverged. If Libet was right, that should have happened at 500 milliseconds before the movement. But the algorithm couldn't tell any difference until about only 150 milliseconds before the movement, the time people reported making decisions in Libet's original experiment.

In other words, people's subjective experience of a decision—what Libet's study seemed to suggest was just an illusion—appeared to match the actual moment their brains showed them making a decision.

When Schurger first proposed the neural-noise explanation, in 2012, the paper didn't get much outside attention, but it did create a buzz in neuroscience. Schurger received awards for overturning a long-standing idea. "It showed the *Bereitschaftspotential* may not be what we thought it was. That maybe it's in some sense artifactual, related to how we analyze our data," says Uri Maoz, a computational neuroscientist at Chapman University.

For a paradigm shift, the work met minimal resistance. Schurger appeared to have unearthed a classic scientific mistake, so subtle that no one had noticed it and no amount of replication studies could have solved it, unless they started testing for causality. Now, researchers who questioned Libet and those who supported him are both shifting away from basing their experiments on the *Bereitschaftspotential*. (The few people I found still holding the traditional view confessed that they had not read Schurger's 2012 paper.)

"It's opened my mind," says Patrick Haggard, a neuroscientist at University College London who collaborated with Libet and reproduced the original experiments.

It's still possible that Schurger is wrong. Researchers broadly accept that he has deflated Libet's model of *Bereitschaftspotential*, but the inferential nature of brain modeling leaves the door cracked for an entirely different explanation in the future. And unfortunately for popular-science conversation, Schurger's groundbreaking work does not solve the pesky question of free will any more than Libet's did. If anything, Schurger has only deepened the question.

Is everything we do determined by the cause-and-effect chain of genes, environment, and the cells that make up our brain, or can we freely form intentions that influence our actions in the world? The topic is immensely complicated, and Schurger's valiant debunking underscores the need for more precise and better-informed questions.

"Philosophers have been debating free will for millennia, and they have been making progress. But neuroscientists barged in like an elephant into a china shop and claimed to have solved it in one fell swoop," Maoz says. In an attempt to get everyone on the same page, he is heading the first intensive research collaboration between neuroscientists and philosophers, backed by $7 million from two private foundations, the John Templeton Foundation and the Fetzer Institute. At an inaugural conference in March, attendees discussed plans for designing philosophically informed experiments, and unanimously agreed on the need to pin down the various meanings of "free will."

In that, they join Libet himself. While he remained firm on his interpretation of his study, he thought his experiment was not enough to prove *total* determinism—the idea that all events are set in place by previous ones, including our own mental functions. "Given the issue is so fundamentally important to our view of who we are, a claim that our free will is illusory should be based on fairly direct evidence," he wrote in a 2004 book. "Such evidence is not available."

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Adam Bear
"What Neuroscience Says about Free Will" (April 28, 2016)

It happens hundreds of times a day: We press snooze on the alarm clock, we pick a shirt out of the closet, we reach for a beer in the fridge. In each case, we conceive of ourselves as free agents, consciously guiding our bodies in purposeful ways. But what does science have to say about the true source of this experience?

In a classic paper published almost 20 years ago, the psychologists Dan Wegner and Thalia Wheatley made a revolutionary proposal: The experience of intentionally willing an action, they suggested, is often nothing more than a post hoc causal inference that our thoughts caused some behavior. The feeling itself, however, plays no causal role in producing that behavior. This could sometimes lead us to think we made a choice when we actually didn't or think we made a different choice than we actually did.

But there's a mystery here. Suppose, as Wegner and Wheatley propose, that we observe ourselves (unconsciously) perform some action, like picking out a box of cereal in the grocery store, and then only afterwards come to infer that we did this intentionally. If this is the true sequence of events, how could we be deceived into believing that we had intentionally made our choice *before* the consequences of this action were observed? This explanation for how we think of our agency would seem to require supernatural backwards causation, with our experience of conscious will being both a product and an apparent cause of behavior.

In a study just published in Psychological Science, Paul Bloom and I explore a radical—but non-magical—solution to this puzzle. Perhaps in the very moments that we experience a choice, our minds are rewriting history, fooling us into thinking that this choice—that was actually completed after its consequences were subconsciously perceived—was a choice that we had made all along.

Though the precise way in which the mind could do this is still not fully understood, similar phenomena have been documented elsewhere. For example, we see the apparent motion of a dot before seeing that dot reach its destination, and we feel phantom touches moving up our arm before feeling an actual touch further up our arm. "Postdictive" illusions of this sort are typically explained by noting that there's a delay in the time it takes information out in the world to reach conscious awareness: Because it lags slightly behind reality, consciousness can "anticipate" future events that haven't yet entered awareness, but have been encoded subconsciously, allowing for an illusion in which the experienced future alters the experienced past.

In one of our studies, participants were repeatedly presented with five white circles in random locations on a computer monitor and were asked to quickly choose one of the circles in their head before one lit up red. If a circle turned red so fast that they didn't feel like they were able to complete their choice, participants could indicate that they ran out of time. Otherwise, they indicated whether they had chosen the red circle (before it turned red) or had chosen a different circle. We explored how likely people were to report a successful prediction among these instances in which they believed that they had time to make a choice.

Unbeknownst to participants, the circle that lit up red on each trial of the experiment was selected completely randomly by our computer script. Hence, if participants were truly completing their choices when they claimed to be completing them—before one of the circles turned red—they should have chosen the red circle on approximately 1 in 5 trials. Yet participants' reported performance deviated unrealistically far from this 20% probability, exceeding 30% when a circle turned red especially quickly. This pattern of responding suggests that participants' minds had sometimes swapped the order of events in conscious awareness, creating an illusion that a choice had preceded the color change when, in fact, it was biased by it.

Importantly, participants' reported choice of the red circle dropped down near 20% when the delay for a circle to turn red was long enough that the subconscious mind could no longer play this trick in consciousness and get wind of the color change before a conscious choice was completed. This result ensured that participants weren't simply trying to deceive us (or themselves) about their prediction abilities or just liked reporting that they were correct.

In fact, the people who showed our time-dependent illusion were often completely unaware of their above-chance performance when asked about it in debriefing after the experiment was over. Moreover, in a related experiment, we found that the bias to choose correctly was not driven by confusion or uncertainty about what was chosen: Even when participants were highly confident in their choice, they showed a tendency to "choose" correctly at an impossibly high rate.

Taken together, these findings suggest that we may be systematically misled about how we make choices, even when we have strong intuitions to the contrary. Why, though, would our minds fool us in such a seemingly silly way in the first place? Wouldn't this illusion wreak havoc on our mental lives and behavior?

Maybe not. Perhaps the illusion can simply be explained by appeal to limits in the brain's perceptual processing, which only messes up at the very short time scales measured in our (or similar) experiments and which are unlikely to affect us in the real world.

A more speculative possibility is that our minds are *designed* to distort our perception of choice and that this distortion is an important feature (not simply a bug) of our cognitive machinery. For example, if the experience of choice is a kind of causal inference, as Wegner and Wheatley suggest, then swapping the order of choice and action in conscious awareness may aid in the understanding that we are physical beings who can produce effects out in the world. More broadly, this illusion may be central to developing a belief in free will and, in turn, motivating punishment.

Yet, whether or not there are advantages to believing we're more in control of our lives than we actually are, it's clear that the illusion can go too far. While a quarter-of-a-second distortion in time experience may be no big deal, distortions at longer delays—which might plague people with mental illnesses like schizophrenia and bipolar disorder—could substantially and harmfully warp people's fundamental views about the world. People with such illnesses may begin to believe that they can control the weather or that they have an uncanny ability to predict other people's behavior. In extreme cases, they may even conclude that they have god-like powers.

It remains to be seen just how much the postdictive illusion of choice that we observe in our experiments connects to these weightier aspects of daily life and mental illness. The illusion may only apply to a small set of our choices that are made quickly and without too much thought. Or it may be pervasive and ubiquitous—governing all aspects of our behavior, from our most minute to our most important decisions. Most likely, the truth lies somewhere in between these extremes. Whatever the case may be, our studies add to a growing body of work suggesting that even our most seemingly ironclad beliefs about our own agency and conscious experience can be dead wrong.

Raj Raghunathan

"Free Will Is an Illusion, So What?" (May 8, 2012)

Think of someone that you dislike. Let's call this person X. Now, imagine that you were born with X's "genetic material." That is, imagine that you had X's looks, body odor, inherent tastes, intelligence, aptitudes, etc. Imagine, further, that you had X's upbringing and life experiences as well; so, imagine that you had X's parents growing up, and that you grew up in the same country, city, and neighborhood in which X grew up, etc.

Would behave any differently from how X behaves?

Most people realize, perhaps after a moment of startled pause, that the answer to the question is "No."

The question helps people realize that their thoughts and actions are determined entirely by their genetic and social conditioning. In other words, it helps people intuitively grasp the idea that free will is an illusion.

Over the past few decades, gathering evidence from both psychology and the neurosciences has provided convincing support for the idea that free will is an illusion. (Read this and this, but for a contrarian view, also read this.) Of course, most people can't relate to the idea that free will is an illusion, and there's a good reason why. It feels as if we exercise free will all the time. For instance, it seems that you are exercising free will in choosing to read this article. Similarly, it seems that you exercise free will when you deny yourself the pleasure of eating tasty-but-unhealthy food, or when you overcome laziness to work out at the gym.

But these choices do not necessarily reflect free will. To understand why, consider why you sometimes deny yourself an unhealthy-but-tasty snack. It's because you were, at some point in your life, made to recognize the long-term negative effects of eating such food. Perhaps you noticed that consuming unhealthy food makes you feel heavy, or that regularly consuming such food makes your blood pressure shoot up. Or perhaps your doctor told you that you need to stop eating unhealthy food; or maybe you read about the negative effects of consuming unhealthy food in a magazine. In other words, you deny yourself the pleasure of consuming unhealthy food because of exposure to external inputs—feedback from your body or from others—over which you had no control. Had you been exposed to a different set of inputs—e.g., despite consuming unhealthy food, your health did not suffer, or your doctor never dissuaded you from eating unhealthy food—you wouldn't deny yourself the pleasure of eating tasty-but-unhealthy food.

If you think carefully about any decision you have made in the past, you will recognize that all of them were ultimately based on similar—genetic or social—inputs to which you had been exposed. And you will also discover that you had no control over these inputs, which means that you had no free will in taking the decisions you did. For instance, you had no choice in where, to whom, and in what period of time, you were born. You also had no choice in the kind of neighbors and friends to whom you were exposed during early childhood. You therefore had no choice in how you made your decisions during that time.

Session 1: The Conflicted Science of Free Will

It might seem, at first blush, that many of the decisions you made later—during late childhood or adolescence—were based on free will, but that is not the case. The decisions you made during late childhood and adolescence were based on the tastes, opinions, and attitudes you had developed in your early childhood, and on those to which you were exposed through your family, friends, media, or the natural environment. And so on, which means that the decision you now make are based on the tastes, opinions and attitudes you have developed over the years or on those to which you are now exposed through contact with the external environment. Looked at in this light, belief in free will is itself a consequence of genetic and social inputs: without the development of the neocortex and without exposure to the idea of free will from societal inputs, we wouldn't believe in free will.

Thus, although it might seem like you exercise free will in overcoming temptations or in overriding self-centered interests, this is not the case. Free will is equally uninvolved when you give into temptations and when you curb them.

If free will is an illusion, what are the implications? How should we think or behave differently?

There are two incorrect and two correct conclusions to which most people arrive when they are introduced to the idea that free will is an illusion. The first incorrect conclusion to which many people arrive is the following: "If free will is an illusion, it is OK for me to give into my impulses and temptations." Several studies have shown that when people are told that free will is an illusion, they are more likely to cheat and less likely to work hard. It is easy to understand why people have this reaction to the idea that free will is an illusion: if giving into temptations is no more or no less an act of free will than is curbing them, why struggle to overcome the temptations?

This way of thinking, however, is incorrect because, although curbing temptations doesn't involve the free will, the consequences from curbing temptations are very different from those that arise from giving into them. Thus, whether or not you act out of free will in denying yourself the unhealthy-but-tasty cake, you will still have to face the health consequences of eating unhealthy meals. Likewise, whether or not you acted out of free will in committing a crime, you will still have to face the consequences of your misdeeds. So, from a purely consequentialist perspective, it makes sense to sometimes curb your temptations.

The second incorrect conclusion to which people arrive is related to the first: "If free will is an illusion, there is no use in punishing wrong-doers." Again, it is easy to see why people think this way. If others did not have a choice in how they behaved, how can they be held culpable? However, although wrong-doers did not have a choice in how they behaved, their behavior still has real and important consequences for the others around them. And more importantly, we know that one of the ways of changing people's behaviors is by exposing them to a set of external inputs—including punishments—that steer them in a different direction.

Thus, it makes sense to mete out punishments to wrong-doers, so as to dissuade them from committing similar types of misdeeds in the future.

This brings me to the first of the two correct conclusions to which people should—but rarely do—arrive after realizing that free will is an illusion.

This conclusion concerns how we treat others for their misdeeds. Although, for reasons explained above, it is important to punish wrong-doers, those who realize that free will is an illusion should mete out the punishments with compassion. Understanding that free will is an illusion means recognizing that people behave in the only way they know how. As such, it is important to realize that, when people act in harmful ways, it is because they are ignorant of the forces that actually shape their thoughts and behaviors.

There are two main reasons why one should be compassionate even towards those who commit misdeeds, such as hurting others. First, those who commit misdeeds are also hurting themselves. As results from research on emotions show, selfish or hurtful acts generally stem from emotional negativity. In other words, it is those feeling angry, insecure, and stressed—and not those feeling happy, secure and relaxed—who are likely to behave badly. And second, those who behave badly are setting themselves up for negative outcomes in the future. In other words, because those who commit misdeeds are currently suffering from emotional negativity or will suffer from negative outcomes in the future, one should be compassionate towards them.

The second implication centers on the attributions that one should make for one's successes and failures. As is well known, people generally tend to take credit for their successes, and tend to blame others or the circumstances for their failures.

Those who recognize that free will is an illusion will realize that their successes and failures have much more to do with "luck"—the set of genetic and social inputs to which they have been randomly exposed—than with their "self-developed" talents and consciously-made choices. Crediting luck for one's successes leads one to experience an entirely different set of emotions—gratitude, elevation, love, etc.—than does taking personal credit for them. Likewise, recognizing the role of the inputs that led to failures promotes learning and wisdom. By contrast, blaming others for failures leads to the experience of anger, and the sense of entitlement that, as I discussed in

So, overall, contrary to what one may initially think, realizing that free will is an illusion should lead to greater maturity, compassion, and emotional stability. Hopefully, the ideas in this article serve as the external inputs that steer you in this positive direction.

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