

# THE ROUTLEDGE COMPANION TO FREE WILL

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## 37 NEUROSCIENTIFIC THREATS TO FREE WILL

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In this chapter, I review recent work on neuroscientific threats to free will. What is it for something to threaten free will? Consider, first, an *apparent* threat. You are walking in the dark, and a shadow looms in the distance. It certainly appears threatening, but you are not sure. What do you do? You consider the source of the threat (the thing casting the shadow, and you attempt to discover whether the threat is *actual* (an attacker) or *merely apparent* (a tree). And if the threat is actual, you attempt to discern what epistemic and behavioral changes are required of you.

It is clear that recent work in neuroscience—along with recent work in psychology (for which see Miller: Chapter 36, this volume)—represents at least an apparent threat. This is why the issue has received so much attention in the popular press, and in the scientific and philosophical literatures. What we are now trying to do is discern whether the threat is actual or merely apparent. If it is actual, then we will have to consider what epistemic and behavioral changes are required of us. If it is merely apparent, then we can go on our way.

Two questions will guide my discussion below. First, does *current* neuroscience present an actual threat? This involves consideration of the main neuroscientific results taken to threaten free will. I do this in the next two sections, “Seemingly Threatening Results,” and “Do These Studies Actually Threaten Free Will?” Second, how does (or might) neuroscience threaten free will? This involves consideration of the source and nature of the apparent threat. Importantly, even if current neuroscience presents no threat, future neuroscience might. Understanding the nature of the apparent threat ought to help us as we look for emerging threats in the near future. In “How Might Neuroscience Threaten Free Will?” I consider recent work that is relevant to this question.

### Seemingly Threatening Results

Amongst the seemingly threatening results, the most widely publicized stem from the work of Benjamin Libet and colleagues (see Libet et al. 1983). Libet had participants decide to flex a wrist while watching a clock and paying attention to the moment they felt an urge to flex. At the same time, Libet monitored electrical activity in the brains of participants. On average, participants reported feeling the urge to flex about 200 milliseconds before they began flexing. This is not that interesting. What was interesting was something happening in participants’ brains before they felt the urge. At about 550 milliseconds before participants began flexing, electrical activity associated with voluntary action preparation began to emerge (more specifically, this is a negative shift in the so-called readiness potential, or RP). According to Libet and other interpreters of this experiment, it looked like this: there was a space of roughly 350 milliseconds during which participants sat watching a clock, while (unbeknownst to them) the brain had either already decided what to do, or was preparing the decision about what to do. Here is how Libet et al. (1983) put it in their seminal paper:

Since onset of RP regularly begins at least several hundreds of milliseconds before the appearance of a reportable time for awareness of any subjective intention or wish to act, it would appear that some neuronal activity associated with the eventual performance of the act has started well before any (recallable) conscious initiation or intervention could be possible. Put another way, the brain evidently ‘decides’ to initiate or, at the least, prepare to initiate the

act at a time before there is any reportable subjective awareness that such a decision has taken place.

(Libet et al. 1983: 640)

Recent work in the Libet tradition has further pressed this line of reasoning by uncovering evidence that in certain experimental conditions, a participant's decision can be predicted—to a level above chance—several seconds before the decision is made. Consider, for example, a recent study by Chun Siong Soon and colleagues (Soon et al. 2013). In this study, participants sat watching a computer screen that displayed changing letters and numbers. Participants were instructed to spontaneously decide whether to add or subtract the passing numbers, and to memorize the letter present when they made this decision. This allowed the experimenters to locate the time of the decision.

Using sophisticated statistical techniques, Soon et al. (2013) were able to decode signals in various regions of the brain that contained predictive information about the upcoming choice. More specifically, up to four seconds before the decision, signals in the medial frontopolar region of the brain predicted the upcoming decision with 59.5 percent accuracy, and signals in the precuneus and posterior cingulate predicted the upcoming decision with 59 percent accuracy.

I turn now to a different line of evidence. It is often taken to bolster the Libet-type results, and to pose a further threat to free will. Since the line of evidence actually encompasses work in both neuroscience and psychology, I will review one study from psychology, before returning to neuroscience. In this study, Daniel Wegner and Thalia Wheatley (1999) had participants sit opposite another person at a table, facing a wooden square which sat on top of a computer mouse. The other person was in fact in collaboration with Wegner and Wheatley. In the study, both people attempted to jointly move the wooden square. As they did so, they watched a cursor on a screen that contained many different objects. Participants were instructed to stop the cursor periodically. Now for a complication: participants wore headphones which played music and words. Participants were told that the words were random distracters, and that the music indicated when they were to stop the cursor. In reality, however, the words would prime the participants by naming objects on the screen.

The movements made by both the participants and the other person (the Wegner and Wheatley collaborator) occurred in two conditions. In one condition, the collaborator would surreptitiously bring the cursor to a stop at a certain object on the screen. In a second condition, the collaborator would not do this, thus allowing the participant to bring the cursor to a stop at a certain object on the screen. After this, participants offered a rating concerning what had just happened. The rating was on a 0 to 100 scale, with 0 indicating 'I allowed the stop to happen' and 100 indicating 'I intended to make the stop.' When the collaborator did nothing, the average participant rating was 56. When the collaborator surreptitiously brought the cursor to a stop, the average rating depended significantly on the words they were hearing through the headphones. If, 30 seconds before the stop, participants heard a word that matched where the cursor came to a stop, their average rating was 44. But if 5 seconds before the stop, participants heard a word that matched where the cursor came to a stop, their average rating was 60. This difference of 16 points on the scale is statistically significant. Wegner and Wheatley concluded that "the experience of will can be created by manipulation of thought and action . . . and this experience can occur even when the person's thought cannot have created the action" (1999: 489).

A very different study—this one from neuroscience—might seem to have the same moral. In this study, Joaquim Brasil-Neto and colleagues (1992) told participants to decide whether to move their right or left index finger after hearing a click. The machine responsible for the click either did or did not direct transcranial magnetic stimulation (TMS) to prefrontal or motor cortex. Interestingly, when TMS was applied to motor cortex, a certain portion of participants (80 percent of those who moved within 200 ms of the click) decided to move the finger corresponding to the place in motor cortex that received TMS. However, according to Brasil-Neto et al., participants reported no awareness of the effect of the TMS. However, those who moved more than 200 ms after the click showed no bias for that finger. Interpreting this result, Brasil-Neto et al. write “it is possible to influence movement preparation processes externally without disrupting the conscious perception of volition . . . [our results] suggest that conscious perception of willing a particular action is preceded, and possibly generated, by cerebral processes that can be influenced by magnetic stimulation” (1992: 966).

These studies are central examples of the body of evidence often taken to threaten free will. Regarding this threat, at least two things deserve attention. First, although there are important differences between these studies, with respect to the purported threat to free will—and seen from a certain height—these studies all tell a similar story. The story is this: with respect to intentional action, and decision-making, how things seem is not how things are. While it seems to most of us as though the conscious mind is in control of deliberation and decision, these studies suggest that this is incorrect. The studies in the Libet tradition suggest that the brain, rather than the conscious mind, takes care of all the significant work in decision-making. The conscious mind, so goes the suggestion, is passive and inefficacious, awaiting the result of the brain’s work. This suggestion receives support from work in the Wegner tradition—work that suggests that the conscious experience of intentional action is in some sense misleading. In “Do These Studies Actually Threaten Free Will?” I review criticisms of these studies.

Second, these studies are not directly about free will. They are about the mechanisms that undergird decision-making, intentional action, and the conscious experience of decision-making and intentional action. So to understand the nature of the threat to free will these studies represent, we need to understand how decision-making, intentional action, and the conscious experience of decision-making and intentional action relate to free will. In other words, philosophical work is required in order to determine whether the threat is actual or merely apparent. In “How Might Neuroscience Threaten Free Will?” I review recent work in this connection.

### **Do These Studies Actually Threaten Free Will?**

Philosophers—and increasingly, scientists—have criticized the threatening studies in a number of ways (for a recent exception, see Caruso 2012). The literature is too big to review in detail: here I restrict attention to the studies reviewed above. Let us begin by considering studies in the Wegner tradition. These are studies that suggest that the conscious experience of intentional action is in some sense misleading. As Wegner has famously argued, “unconscious and inscrutable mechanisms create both conscious thought about action and the action, and also produce the sense of will we experience by perceiving the thought as cause of the action” (2002: 98).

But do the studies reviewed above offer support to this claim? A number of philosophers (e.g., Nahmias 2002; Bayne 2006) have noted that Wegner’s claim seems to depend on

a kind of inductive generalization: a move from the discovery that some conscious experiences of action are misleading to the claim that all (or most) conscious experiences of action are misleading. But this is problematic: that some experiences are misleading does not license the claim that the mechanisms responsible for these experiences are systematically misleading: much more evidence is needed to establish a claim like that (see Bayne 2006: 179, 180). Indeed, much subsequent work into the mechanisms responsible for generating (or the mechanisms that simply subserve) experiences of action indicates that they are quite reliable. The mechanisms responsible for our experiences of agency, while imperfect indicators of agency, appear to be closely related to the mechanisms responsible for initiating and controlling action (see Pacherie 2008, Synofzik et al. 2008). This at least suggests—without proving, of course—that our experiences of acting, deciding, and the like, are not *systematically* misleading (for more discussion of this point, see “Free Will and the Phenomenology of Agency,” Chapter 56, this volume; Shepherd 2016).

Further, many have raised more specific problems with the central studies. I will focus on the Wegner and Wheatley study reviewed above (for discussion of the Brasil-Neto et al. (1992) study, see Shepherd 2013). Recall Wegner and Wheatley’s interpretation of that study: “the experience of will can be created by manipulation of thought and action . . . and this experience can occur even when the person’s thought cannot have created the action” (1999: 489). Recall that on a 0 to 100 scale, participants offered ratings in the mid-50s where 100 represented ‘I intended to make the stop.’ Notice that this statement says nothing about the experience of will: it is about the existence of an intention. But even putting that complication aside, Joshua Shepherd (2013) has noted that “the rating of 56% indicates a degree of confusion about what, if anything, was decided,” and further, that we do not know how participants interpreted the scale. Given this, it is plausible that participants “simply felt that the action occurred thanks in part to their participation,” (Shepherd 2013: 24) rather than that the action occurred because of some experience of will on their part. Given their actual data, Wegner and Wheatley’s claim appears far too strong. (The same criticism applies to interpretations of a similar experiment given in Wegner et al. [2004].)

I turn to studies in the Libet tradition. The literature discussing these studies is large. But most agree that the most sophisticated treatment of these studies and their relevance for free will is Alfred Mele’s (2009) book *Effective Intentions* (see also Bayne 2011 for an excellent discussion). In meticulous detail, Mele argues for the following claims (among others). First, it is doubtful that Libet-style studies show that the brain decides before the conscious mind is aware of the decision. Instead, these studies at best offer evidence of early nonconscious preparation for decision, which is compatible with the decision being made consciously. Second, Libet-style studies do not rule out the possibility that conscious intentions cause the relevant behavior—the wrist-flexing. Although it is sometimes asserted that Libet-style studies show intentions emerge ‘too late’ to do any causal work, Mele reviews work on reaction times that indicates Libet’s data in fact leave enough time for participants in these studies to acquire intentions to flex and for these intentions to initiate the flexing. Third, since Libet-style studies involve simple actions such as the flexing of a wrist, it is unclear whether the data they generate speak to the kinds of decisions that matter—decisions that involve the weighing of reasons for and against action (for more on this point, see Roskies 2010). Indeed, Mele notes it is relatively unsurprising that we are not aware of what produces simple movements such as wrist-flexings. What would be surprising is a lack of awareness

regarding our reasons for action in decisions that matter (for discussion of some relevant data on this point, see Miller: Chapter 36, this volume). Mele writes, “If we never had any more insight into why we decided as we did than [do participants in Libet-style experiments] . . . we would be much more mysterious to ourselves than we actually are” (2009: 87).

Since the publication of Mele’s book, emerging neuroscience has, if anything, trended in a free will-friendly direction. It looks, for example, like the Libet-style results do not generalize to decisions that matter. Susan Pockett and Suzanne C. Purdy review evidence that “RPs often do not occur at all before movements initiated as a result of decisions, as opposed to spontaneous urges” (2010: 34). And without any relevant RP pattern, there is little reason to think that the processes responsible for felt urges and wrist-flexes in Libet-style studies are also responsible for decisions and the experience of decision-making in other contexts.

Further, neuroscientists Aaron Schurger, Jacobo D. Sitt, and Stanislas Dehaene (2012) offer data supporting the view that the Readiness Potential—the signal often interpreted as the brain deciding or preparing to decide what to do—does not reflect anything like a decision. Instead, the Readiness Potential might reflect little more than neural noise—the kind of gradual increase in neural activity that precedes many spontaneous movements, but is not present in all cases of intentional movements. Schurger et al. (2012) summarize as follows:

We suggest reserving the term ‘decision’ to the commitment to move achieved once neural activity (spontaneous or goal directed) crosses a specific threshold . . . The reason we do not experience the urge to move as having happened earlier than about 200 ms before movement onset is simply because, at that time, the neural decision to move (crossing the decision threshold) had not yet been made. A very similar fluctuation in neuronal firing could equally well, at some other time, have not preceded the movement . . . We propose that the neural decision to move coincides in time with average subjective estimates of the time of awareness of intention to move and that the brain produces a reasonably accurate estimate of the time of its movement-causing decision events.

(Schurger et al. 2012: E2910)

This looks pretty devastating to anti-free will interpretations of the Libet data. Notice, though, that Schurger et al. (2012) continue to speak of what happens at 200 ms before a wrist flex as a “neural decision.” But recent work indicates it is not even that. Han-Gue Jo and colleagues (Jo et al. 2013) had an expert meditator go through a Libet-style experiment. In one condition they asked the participant to notice when an urge to flex appeared in consciousness, and then to wait for as long as possible before flexing. When this was done, the RP showed a similar pattern before the urge appeared, but crucially, the RP did not immediately cause the wrist flexing. Instead, the participant waited for up to 3 seconds before flexing. It is plausible, then, that the RP reflects neural preparation not for a decision, but for the appearance of an urge to move in consciousness—an urge that at least some participants are free to follow or reject.

The proper conclusion, then, is that current neuroscience does not present an actual threat to free will. Even so, everyone should acknowledge that the science of agency is far from complete. It remains possible that future neuroscience will offer an actual

threat to free will. As such, it is important to reflect on why current neuroscience is often taken to offer such a threat. This kind of reflection might help us see the kinds of results that may, in the future, actually threaten free will.

### How Might Neuroscience Threaten Free Will?

Surveying recent work related to this question, at least four answers emerge. I will take them one at a time.

First, neuroscience might threaten free will if work in neuroscience is able to show that the brain is deterministic. Now, whether determinism is a threat depends on what conditions turn out to be required for the possession of free will. Compatibilists maintain that free will is compatible with the truth of determinism. So if neuroscientists were to show that the brain—and especially the processes responsible for deliberation and decision-making—operated according to deterministic causal laws, only libertarians about free will would find this threatening.

However, neuroscience is unlikely to show any such thing. Adina Roskies observes that since “we have no objective access to either determinism or indeterminism” the best we can do is to operationalize determinism as predictability (Roskies 2014: 105). Given this limitation, we are unlikely to discover compelling evidence for indeterminism – deterministic systems can display stochastic, and thus seemingly indeterministic, behavior (although see Tse [2013] for an argument that the brain is an indeterministic system, and that this is crucial for our free will). But does this preclude us finding compelling evidence for determinism? Roskies asks us to imagine that we acquire full information about some area in the brain that subserves decision-making, such that “we could with perfect accuracy predict the subsequent behavior of the agent” (2014: 116). This might offer some inductive evidence in favor of determinism. But since any given brain area—and indeed, the brain itself—is an open causal system, it is always possible that an event *somewhere else* influences the operation of the system in question, rendering the process indeterministic. We might someday revise current physical theory in favor of determinism—but that will result from advances in theoretical physics, not advances in neuroscience.

Second, neuroscience might threaten free will if work in neuroscience is able to show that naturalism about the mental—the claim that minds operate entirely according to natural laws, and thus that there is no place for souls or otherwise non-natural substances in our understanding of agency—is true. As with determinism, whether naturalism about the mental threatens free will depends on what conditions turn out to be required for the possession of free will. Naturalism is threatening only if free will requires the operation of souls or otherwise non-natural substances.

There is evidence that some people understand free will in this way (Nadelhoffer et al. 2014). But there is evidence that some people do not understand free will in this way as well (Mele 2014). For all we currently know, evidence in favor of naturalism about the mental would threaten some people’s understanding of free will. At this point one is tempted to ask: what about free will itself? Does free will *really* require non-naturalism about the mental? One’s answer to this question will depend on one’s view about a range of controversial views in metaphysics, the philosophy of mind, and the philosophy of action. Although most living philosophers—this one included—are naturalists about the mental, there remain many who disagree. This is not the place to settle disputes on this issue. But it is worth noting that even if neuroscience could demonstrate



the truth of naturalism about the mental, serious philosophical work would be required to determine whether this presented an actual as opposed to a merely apparent threat to free will.

It is, of course, dubious that neuroscience could *prove* the truth of a metaphysical thesis like naturalism. But neuroscience might, as Eddy Nahmias argues, render naturalism more plausible “by providing increasingly complete explanations for observable events in the universe, including human behavior, in terms of natural processes and laws” (2014: 8, 9). It is thus plausible, then, that if free will requires non-naturalism about the mental, then neuroscience (with science generally) represents a threat to free will, one that non-naturalists about free will should be motivated to confront.

Third, neuroscience might threaten free will if work in neuroscience is able to show that talk of mental states and mental causes of action is eliminable—if the best explanation of human agency need refer only to causal processes at the neurobiological level. According to this possibility, neuroscience is showing (or will one-day show) that the best explanation of human agency need make no reference to intentions, decisions, and the like. Here is how the neuroscientist William T. Newsome articulates this possibility.

The critical question is whether our beliefs, values, and aspirations . . . are real entities with real causal efficacy in the world or whether they are illusory constructs that we make up to describe our experience of a world whose causal determinants lie at a much more fundamental level. Many neuroscientists appear to subscribe to the latter point of view, leading to skepticism about our own ability to control our actions and effect change in the world. This conviction seems to be driven by a reductionist methodology (and ideology!) that is *eliminative* in the sense that it seeks to replace high-level constructs and processes with lower level explanations where *fundamental* truth is thought to lie.

(Newsome 2014: 93)

And here is Francis Crick endorsing the possibility as fact: “your memories and your ambitions, your sense of personal identity and free will are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules” (1994: 3).

Now, most philosophers agree that if this kind of ruthlessly reductionist eliminativism were correct, free will would be under dire threat. But it is important to note that many philosophers, as well as many scientists, find nothing in current neuroscience that warrants this kind of eliminativism.

Newsome does a nice job of summarizing the reasons why. First, positing mental states such as beliefs, desires and intentions continues to give us extraordinary predictive power regarding human behavior—a predictive power neuroscience cannot, at present, match. Second, treating human agents as systems driven by mental states continues to give us extraordinary manipulative power regarding human behavior—a manipulative power neuroscience cannot, at present, match. Third, a theory that posits behaviorally relevant mental states such as beliefs, desires, and intentions is much more parsimonious than a theory that attempts to explain all behavior by reference to the interactions between the environment and the nervous system.

Although it might turn out to be true that the best explanation of human agency is eliminativist, at present, we have little reason to think this is so. However, neuroscience



is young. It is possible that as knowledge about the brain increases, our folk psychological categories will come to seem less and less useful as explanatory constructs. If so, we will have to refine or eliminate these categories. But it is difficult to predict whether the growth of knowledge will constitute a threat to free will, or whether this growth will simply refine our understanding of how free will works. Even so, for those on the lookout for threats to free will, the eliminativist threat is something to keep in mind as neuroscience progresses.

Fourth, neuroscience might threaten free will if work in neuroscience is able to show that modular epiphenomenalism is true. Modular epiphenomenalism is, according to Eddy Nahmias, the view that “those modules involved in conscious decisions or intention formation do not produce our behavior; rather other modules or processes that involve no conscious states produce our behavior” (2014: 12). This looks like something that neuroscience might be able to confirm or disconfirm. Indeed, early indications such as those reviewed in the last section are that modular epiphenomenalism is false. But suppose we were to discover that it is true (at least sometimes). Would we thereby have discovered an actual threat to free will?

I can see at least two reasons to think that the answer is yes. The first stems from epistemic considerations. If modular epiphenomenalism is true, then the way things seem to us regarding decision-making is not the way that things are. While it seems like our deliberation is effective, and while it seems like we often consciously decide for reasons, in fact, the processes that produce our decisions and actions are opaque to us. This raises a problem about how well we understand what we are doing when we are acting. Perhaps we are often wrong about the considerations driving our intention acquisition and our subsequent action. If so, we might have reason to worry about whether such systematic illusion about the sources of our action is consistent with our actions being free. David Rosenthal suggests something like this thought in the following passage: “Acting freely consists not in our volitions being uncaused, but in those volitions fitting comfortably within a conscious picture we have of ourselves and of the kinds of things we characteristically want and do” (2002: 219). Plausibly, free will—especially the kind of free will required for attributions of moral responsibility—requires a lack of ignorance about what one is doing (Zimmerman 1997). Insofar as modular epiphenomenalism suggests that agents are often ignorant of why they decide as they do, modular epiphenomenalism will threaten free will.

A second reason modular epiphenomenalism might constitute an actual threat to free will has to do with consciousness. It is a widely held intuition that consciousness is somehow very important for free will (see, e.g., Shepherd 2012). Some philosophers appear to think consciousness is necessary (in some way) for free will. So, for example, Robert Kane has recently claimed that

if conscious will were an illusion or epiphenomenalism or eliminative reductionism were true, all theories of freedom and responsibility would be threatened, compatibilist and libertarian alike, since they all require, to some degree at least, causally efficacious conscious mental processes.

(2014: 129)

Gregg Caruso agrees, asserting that “Our folk psychological theory [of free will] requires not only mental causation but conscious will! (2012: 212). And Ted Honderich has recently claimed that “The subject of freedom and responsibility has never been

separable from the subject of consciousness . . . there is no question at all of freedom and responsibility with respect to what is unconscious” (2013: 60).

Interestingly, however, not everyone shares this intuition. The neurologist Mark Hallett, for example, asks whether the purported inefficacy of conscious will actually threatens free will, and answers as follows. “Since ‘I’ am my brain, it is not necessary to ask this question only in relation to what is conscious. It is possible to say that a brain is free if the brain can function without external constraint” (Hallett 2013: 262). The philosopher Sven Walter rejects the importance of consciousness: “why should anyone accept that decisions and actions can be free only if they have been caused *by the feeling of having consciously willed them?* . . . There are neither theoretical reasons for such a conception of free will, nor do there seem to be any pre-theoretic intuitions that mandate it” (Walter 2014: 18). And David Rosenthal downplays the difference between conscious and nonconscious mental states:

it is plain that there is no difference in respect of freedom between conscious and nonconscious volitions. In both cases volitions result from various antecedent mental occurrences of which we are largely unaware. Conscious volitions differ from those which are not conscious only in that we are conscious of them.

(2002: 219)

Which side is right? Answering this question will require an increase in attention to the relationships between consciousness, decision-making and intentional action (see “Free Will and the Phenomenology of Agency,” Chapter 56, this volume; Levy: Chapter 38, this volume), as well as an increase in attention to the relationships between consciousness and free will. What about consciousness makes it important for free will, if it is? Recent work in the philosophy of action has begun to examine this question (see, e.g., Hodgson 2012; Tse 2013; Levy 2014). We might hope that progress in this area will substantially clarify the nature of the threat to free will presented by modular epiphenomenalism.

### Conclusion

As we have seen, a range of results in neuroscience present an apparent threat to free will. These are results that suggest that with respect to decision-making and intentional action, how things seem is not how they are. I have reviewed a number of criticisms of the relevant neuroscience, however, and have suggested that the threat presented by current neuroscience is not actual, but merely apparent. Even so, given the relative youth of neuroscience, we can expect that advances in our knowledge of the brain will continue to present apparent threats to free will. Determining whether these apparent threats are actual threats—and if so, determining the epistemic and behavioral changes they require—will require continued attention to the neuroscientific details as well as to the philosophical issues raised by the details.

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## References

- Bayne, T. (2006) "Phenomenology and the Feeling of Doing: Wegner on the Conscious Will," in S. Pockett, W.P. Banks, and S. Gallagher (eds), *Does Consciousness Cause Behavior?* Cambridge: MIT Press, pp. 169–86.
- Bayne, T. (2011) "Libet and the Case for Free Will Scepticism," in R. Swinburne (ed.), *Free Will and Modern Science*. Oxford: Oxford University Press, pp. 25–46.
- Brasil-Neto, J., Pascual-Leone, A., Valls-Solé, J., Cohen, L., and Hallett, M. (1992) "Focal Transcranial Magnetic Stimulation and Response Bias in a Forced Choice Task," *Journal of Neurology, Neurosurgery, and Psychiatry* 55: 964–6.
- Caruso, G.D. (2012) *Free Will and Consciousness: A Determinist Account of the Illusion of Free Will*. Lanham: Lexington Books.
- Crick, F. (1994) *The Astonishing Hypothesis*. New York: Scribner.
- Hallett, M. (2013) "What Does the Brain Know and When Does It Know It?" in G.D. Caruso (eds), *Exploring the Illusion of Free Will and Moral Responsibility*. Lanham: Lexington Books, pp. 255–64.
- Hodgson, D. (2012) *Rationality + Consciousness = Free Will*. Oxford: Oxford University Press.
- Honderich, T. (2013) "Determinism, Incompatibilism and Compatibilism, Actual Consciousness and Subjective Physical Worlds, Humanity," in G.D. Caruso (ed.), *Exploring the Illusion of Free Will and Moral Responsibility*. Lanham: Lexington Books, pp. 53–64.
- Jo, H.G., Hinterberger, T., Wittmann, M., Borghardt, T.L., and Schmidt, S. (2013) "Spontaneous EEG Fluctuations Determine the Readiness Potential: Is Preconscious Brain Activation a Preparation Process to Move?" *Experimental Brain Research* 231: 495–500.
- Kane, R. (2014) "Free Will, Mechanism, and Determinism: Comments on Roskies, 'Can neuroscience resolve issues about free will?'" in W. Sinnott-Armstrong (ed.), *Moral Psychology: Free Will and Moral Responsibility*, Vol. 4. Cambridge: MIT Press, pp. 127–38.
- Levy, N. (2014) *Consciousness and Moral Responsibility*. Oxford: Oxford University Press.
- Libet, B., Gleason, C.A., Wright, E.W., and Pearl, D.K. (1983) "Time of Conscious Intention to Act in Relation to Onset of Cerebral Activity (Readiness-Potential): The Unconscious Initiation of a Freely Voluntary Act," *Brain* 106: 623–42.
- Mele, A.R. (2009) *Effective Intentions: The Power of Conscious Will*. Oxford: Oxford University Press.
- Mele, A.R. (2014) "Free Will and Substance Dualism: The Real Threat to Free Will?" in W. Sinnott-Armstrong (ed.), *Moral Psychology: Free Will and Moral Responsibility*, Vol. 4. Cambridge: MIT Press, pp. 227–34.
- Nadelhoffer, T., Shepard, J., Nahmias, E., Sripada, C., and Ross, L.T. (2014) "The Free Will Inventory: Measuring Beliefs about Agency and Responsibility," *Consciousness and Cognition* 25: 27–41.
- Nahmias, E. (2002) "When Consciousness Matters: A Critical Review of Daniel Wegner's *The Illusion of Conscious Will*," *Philosophical Psychology* 15: 527–41.
- Nahmias, E. (2014) "Is Free Will an Illusion? Confronting Challenges from the Modern Mind Sciences," in W. Sinnott-Armstrong (ed.), *Moral Psychology: Free Will and Moral Responsibility*, Vol. 4. Cambridge: MIT Press, pp. 1–26.
- Newsome, W. T. (2014) "Neuroscience, Explanation, and the Problem of Free Will," in W. Sinnott-Armstrong (ed.), *Moral Psychology: Free Will and Moral Responsibility*, Vol. 4. Cambridge: MIT Press, pp. 81–96.
- Pacherie, E. (2008) "The Phenomenology of Action: A Conceptual Framework," *Cognition* 107: 179–217.
- Pockett, S. and Purdy, S. (2010) "Are Voluntary Movements Initiated Preconsciously? The Relationships between Readiness Potentials, Urges and Decisions," in W. Sinnott-Armstrong and L. Nadel (eds), *Conscious Will and Responsibility: A Tribute to Benjamin Libet*. Oxford: Oxford University Press, pp. 34–46.
- Rosenthal, D.M. (2002) "The Timing of Conscious States," *Consciousness and Cognition* 1: 215–20.
- Roskies, A. (2010) "Why Libet's Studies Don't Pose a Threat to Free Will," in W. Sinnott-Armstrong and L. Nadel (eds.), *Conscious Will and Responsibility: A Tribute to Benjamin Libet*. Oxford: Oxford University Press.
- Roskies, A. (2014) "Can Neuroscience Resolve Issues about Free Will?" in W. Sinnott-Armstrong (ed.), *Moral Psychology: Free Will and Moral Responsibility*, Vol. 4. Cambridge: MIT Press, pp. 103–26.
- Schurger, A., Sitt, J.D., and Dehaene, S. (2012) "An Accumulator Model for Spontaneous Neural Activity Prior to Self-Initiated Movement," *Proceedings of the National Academy of Sciences* 109: E2904–13.
- Shepherd, J. (2012) "Free Will and Consciousness: Experimental Studies," *Consciousness and Cognition* 21: 915–27.

- Shepherd, J. (2013) "The Apparent Illusion of Conscious Deciding," *Philosophical Explorations* 16: 18–30.
- Shepherd, J. (2016) "Conscious Action/Zombie Action," *Noûs* 50(2): 419–44.
- Soon, C.S., He, A.H., Bode, S., and Haynes, J.D. (2013) "Predicting Free Choices for Abstract Intentions," *Proceedings of the National Academy of Sciences* 110: 6217–22.
- Synofzik, M., Vosgerau, G., and Newen, A. (2008) "Beyond the Comparator Model: A Multifactorial Two-Step Account of Agency," *Consciousness and Cognition* 17: 219–39.
- Tse, P. (2013) *The Neural Basis of Free Will: Criterial Causation*. Cambridge: MIT Press.
- Walter, S. (2014) "Willusionism, Epiphenomenalism, and the Feeling of Conscious Will," *Synthese* 191: 2215–38.
- Wegner, D.M. (2002) *The Illusion of Conscious Will*. Cambridge: MIT Press.
- Wegner, D.M., Sparrow, B., and Winerman, L. (2004) "Vicarious Agency: Experiencing Control Over the Movements of Others," *Journal of Personality and Social Psychology* 86: 838–48.
- Wegner, D.M. and Wheatley, T. (1999) "Apparent Mental Causation: Sources of the Experience of Will," *American Psychologist* 54: 480–92.
- Zimmerman, M.J. (1997) "Moral Responsibility and Ignorance," *Ethics* 107: 410–26.

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## Further Reading

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- Caruso, G.D. (2012) *Free Will and Consciousness: A Determinist Account of the Illusion of Free Will*. Lanham: Lexington Books. (A free will skeptic's interpretation of recent work in cognitive science.)
- Levy, N. (2014) *Consciousness and Moral Responsibility*. Oxford: Oxford University Press. (The most thorough exploration to date of the role of consciousness in morally responsible action.)
- Mele, A.R. (2009) *Effective Intentions: The Power of Conscious Will*. Oxford: Oxford University Press. (A systematic and illuminating discussion of Libet-style studies and their relevance to free will.)
- Tse, P. (2013) *The Neural Basis of Free Will: Criterial Causation*. Cambridge: MIT Press. (A neuroscientist argues that recent work in neuroscience actually explains, rather than threatens, free will.)

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## Related Topics

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Situationism, Social Psychology, and Free Will  
Empirical Perspectives on Consciousness and its Relationship to Free Will and Moral Responsibility  
Willpower, Freedom, and Responsibility  
Addiction  
Free Will and the Phenomenology of Agency