LIBET-STYLE EXPERIMENTS, NEUROSCIENCE, AND LIBERTARIAN FREE WILL*

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Abstract: People have disagreed on the significance of Libet-style experiments for discussions about free will. In what specifically concerns free will in a libertarian sense, some argue that Libet-style experiments pose a threat to its existence by providing support to the claim that decisions are determined by unconscious brain events. Others disagree by claiming that determinism, in a sense that conflicts with libertarian free will, cannot be established by sciences other than fundamental physics. This paper rejects both positions. First, it is argued that neuroscience and psychology could in principle provide support for milder deterministic claims that would also conflict with libertarian free will. Second, it is argued that Libet-style experiments—due to some of their peculiar features, ones that need not be shared by neuroscience as a whole—currently do not (but possibly could) support such less demanding deterministic claims. The general result is that neuroscience and psychology could in principle undermine libertarian free will, but that Libet-style experiments have not done that so far.

Keywords: Benjamin Libet; determinism; free will; libertarianism; neuroscience

1 Introduction

Recent discussions about free will and cognitive science (especially neuroscience) were largely influenced by some intriguing and controversial experiments conducted by Benjamin Libet and others in the 1980s (see Libet, Gleason, Wright & Pearl, 1983; Libet, Wright, Feinstein & Pearl, 1982; and Libet, 1999). It was known at the time that a specific sort of neural activity called ‘readiness potential’ (RP) preceded voluntary movements (Kornhuber & Deecke 1965). Libet sought to investigate the temporal relation between RPs, movements, and the moment when subjects become conscious of wanting to move. He found that RPs start on average approximately 350 milliseconds before the subjects’ reported times of a conscious urge or wish to flex a finger, and approximately 500 milliseconds before actual movement (Libet et al., 1983; Libet 1999).[1] Libet concluded that the voluntary acts under examina-

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1 This information refers only to what Libet calls ‘type II’ RP, i.e., RPs preceding movements for which subjects reported no previous planning of the moment to move. For other conditions, see Libet et al.

tion are initiated unconsciously in the brain. More recently, Soon, Brass, Heize, and Heynes (2008) found neural activity that predicts which of two buttons a subject will push 7 seconds (or even 10 seconds) before the subject has consciously decided between the options. Although the accuracy of the prediction is less than roughly 60%, the authors conclude that conscious decisions are determined by unconscious neural activity.

There has been considerable disagreement about the significance of this kind of result for debates about the existence of free will. The aim of this paper is to assess these divergences with regard to a particular conception of free will, namely, libertarian free will. For the purposes of this paper, let us understand as 'libertarian' any conception that holds that free will is incompatible with determinism. ('Determinism' will be characterized in section 3.) Below, I start by framing current disputes on the impact of Libet-style experiments on libertarian free will (section 2), and then I argue for two theses. The first is that, contrary to what some have defended, neuroscience and psychology can, in principle, establish modest deterministic claims that might threaten libertarian free will (section 3). The second is that Libet-style experiments have not so far established that sort of claim, though they could in principle (section 4). Neuroscience and psychology could in principle undermine libertarian free will, but Libet-style experiments have not yet done that.

2 Disputes on the impact of Libet-style experiments on libertarian free will

Some people have interpreted results from Libet-style experiments as a straightforward case against free will. Haynes, the senior author in Soon et al. (2008), for example, describes the challenge as follows:

> our and Libet's findings do address one specific intuition regarding free will, that is the naïve folk-psychological intuition that at the time when we make a decision the outcome of this decision is free and not fully determined by brain activity. (Haynes, 2011, p. 92)

Similarly, Misirlisoy and Haggard describe a

> personal experience [that] provides a powerful impetus for the folk concept of free will. We consciously decide on a course of action and only then we do carry out the relevant actions to fulfill it. When presented with a choice of two options, we may think about them, and then we perform a con-

(1982, 1983). It is worth noting that both the specific measurements and the implications for free will of Libet's results are a matter of dispute. On the former, mentioned difficulties include the effects of instructions and training during the experiments, and subjects' ability to accurately report the time of decisions (see, e.g., Gomes, 1998; Banks & Isham, 2011; and Maoz, Mudrik, Rivlin, Ross, Mamelak et al., 2015). Questions related to the latter point include the representativeness and significance of finger flexions for free will, the precise nature of the mental phenomena investigated, and various others (see, e.g., Mele, 2006, 2009, the essays in Mele, 2015, in Sinnott-Armstrong & Nadel, 2011, in Part II of Pockett, Banks & Gallagher, 2006, and most of what is discussed below).

> scious selection between them by exercising our will. In this sense, our will is experienced as free. (Misirlisoy & Haggard, 2014, p. 37)

And they add—partly on the basis of the results in Soon et al. (2008)—that neuroscience has "called this intuition into question, by showing that unconscious activity in the brain preceding our intention—activity that we are never aware of—predicts the emergence of that specific intention to act" (Misirlisoy & Haggard, 2014, p. 38).

The reasoning in these passages seems to be as follows. First, our intuitive conception of free will is said to require that our decisions are not determined by previous (allegedly unconscious) activity in the brain; in other words, a libertarian view of free will is considered a common intuition. But, second, Libet-style experiments are said to undermine this intuition. As a consequence, our intuitive, libertarian notion of free will is an illusion.

Such confidence in the implications of neuroscience for the free will debate has been challenged by others, notably in philosophy. Nahmias (2014b, p. 5) offers the following argument schema as a means of clarifying how Libet-style experiments and other results from cognitive science can have an impact on the debate:

1. Free will requires that X is not the case.
2. Science is showing that X is the case (for humans).
3. Thus, science is showing that humans lack free will.

He then analyzes a group of candidates for "X", the first of which is "determinism." He gets the following argument (see Nahmias, 2014b, p. 5):

D1. Free will requires that determinism is not the case.
D2. Science is showing that determinism is the case (for humans).
D3. Thus, science is showing that humans lack free will.

Premise D1 states a form of incompatibilism, and given premise D2, the argument as a whole is a form of hard determinism: free will requires determinism to be false, but since determinism is true, there is no free will.

Nahmias denies, first, that Libet-style experiments can support premise D2 because they would not be in a position to establish determinism such as it is understood by incompat-

ibilists:

> In incompatibilist arguments, determinism is defined as the thesis that a complete description of a system (e.g., the universe) at one time and of all the laws that govern that system logically entails a complete description of that system at any future time. (2014b, p. 6)

Nahmias says that this sort of determinism "requires a closed system," and then objects that the brains and behaviors studied by cognitive scientists are not closed systems. He adds that results such as those in Soon et al. (2008) "do *not* show that, given prior events … certain decisions or behavior *necessarily* occur" (Nahmias, 2014b, p. 6).

Roskies (2006) offers a similar argument for the claim that neuroscience cannot tell whether the universe is, at a fundamental level, determinist. She argues that observed determinism or indeterminism at one level of description cannot be taken as evidence that another level is deterministic or indeterministic. For example, neuroscientists could come to the conclusion that brains are indeterministic. But, due to the possibility of deterministic chaos, she says, "apparent indeterminism in one level of description is entirely compatible with determinism at the fundamental physical level" (2006, pp. 420–421). In this way, Roskies accepts that "neuroscience can indicate … that, regardless of whether or not the universe is deterministic, the brain effectively is" (2006, p. 421), but insists that it is determinism at the fundamental physical level that is critical for the traditional debate about free will.

Before going ahead, I should mention that Nahmias and Roskies also doubt premise D1 in the argument above. Nahmias argues that cognitive scientists cannot simply assume that premise D1 accurately represents philosophers' and laypersons' views. According to him, most philosophers as well as most laypersons seem to be *compatibilists*. Regarding philosophers' beliefs, we have evidence from Bourget and Chalmers' (2013) online survey. And, regarding laypersons' beliefs, Nahmias mentions results in experimental philosophy by himself and colleagues (Nahmias, Coates, & Kvaran, 2007; Nahmias, Morris, Nadelhoffer, & Turner, 2006; see also note 5). And Roskies (2006, p. 422), partly drawing on the same experimental data, also doubts that neuroscience could have an impact on ordinary practices of responsibility, even if it could affect ordinary conceptions about free will.

In the following sections, I do not focus on the question whether compatibilism is conceptually stronger, nor on whether it represents common thought more accurately than incompatibilism. Instead, the focus is on whether Libet-style experiments (and neuroscience, more generally) are, or can be, a threat to free will *if* incompatibilism is correct, or, as we may put it, if Libet-style experiments (and neuroscience) do, or could, undermine a libertarian concep-

tion of free will. This is precisely what is at issue: The scientists mentioned above claim that such experiments actually exclude libertarian free will; the philosophers mentioned claim that neuroscience could not do that in principle.

3 Neuroscience, determinism, and libertarian free will

Let us begin by assessing the claim that neuroscience cannot establish a sort of determinism that is incompatible with libertarian free will. It is true, as Nahmias says, that in discussions between compatibilists and incompatibilists, determinism is often characterized as a thesis concerning the workings of the universe as a whole. In that sense (let us label it 'universal determinism'), the thesis says, roughly, that the occurrence of *all* events in the universe—including, of course, human decisions and actions—can be deduced from a complete description of previous events and the laws of nature. For the purposes of this paper, I will ignore whether neuroscience can support determinism so defined. I want to ask instead if there are more modest forms of determinism that are both (a) capable of undermining libertarian free will, and (b) supportable, at least in principle, by neuroscience. I claim that there are, and in order to develop my argument I focus first on why incompatibilists take universal determinism to threaten free will.

In general, libertarians reject universal determinism because, for them, free will requires that we do have (at least sometimes) alternative possibilities for what we do *and choose*. Chisholm (1964), for example, claims that one acts freely only if one could have done otherwise. But he rejects a (compatibilist) conditional analysis of "could have done otherwise," that is, an interpretation in which "one could have done otherwise" means that "one would have done otherwise *if* one had chosen otherwise." Instead of such an analysis—which is consistent with the possibility that, given prior events and the laws of nature, she could not choose otherwise—Chisholm holds that "one could have done otherwise" requires "one could have *chosen* otherwise":

> Suppose, after all, that our murderer could not have *chosen*, or could not have *decided*, to do otherwise. Then the fact that he happens also to be a man such that, if he had chosen not to shoot he would not have shot, would make no difference. For if he could *not* have chosen *not* to shoot, then he could not have done anything other than just what it was that he did do. (1964, pp. 175-176)

In a similar way, Kane says that

> when we wonder about whether the *wills* of agents are free, it is not merely whether they could have done otherwise that concerns us […] What concerns us is whether they could have done otherwise *voluntarily* (or *willingly*)… (2009, p. 275)

In order to be able to do otherwise voluntarily, as Kane says, one must be able to choose otherwise. We have again the requirement of alternative choice possibilities. However, Kane does not think it generalizes to every action. For him, libertarian free will requires alternative possibilities only for *some* actions, those which he labels "self-forming actions" (SFAs). In this way, an action results from free will if it is either an SFA or formed on the basis of previous SFAs (Kane, 2009, p. 272). It is because universal determinism entails that (given what happened in the past and the laws of nature) we *never* have alternative possibilities that libertarians regard it as incompatible with free will. For if everything (including actions and decisions) is determined by past events and the laws of nature, then no one can ever choose otherwise.

But now it should become clear that even less demanding forms of determinism can conflict with libertarian free will. As a first possibility, we might have claims that *particular sorts* of events are determined—I will refer to these as "statements of local determination." Consider the following schema for generating statements of this sort:

LD. For any event *x*, if an *x* that is *P* occurs, then another event, *y*, that is *Q*, will occur.[2]

LD says that whenever there is an event of sort P, this fact entails that there will be a second event of sort Q, that is, events of sort P *determine* the occurrence of events of sort Q. We can imagine a similar law that would prevent an individual from choosing otherwise given the occurrence of some previous event whose occurrence was not within the individual's control:

LD1. For any event *x*, and any subject *s*, if an *x* that is a pattern of neural activity of type *B* occurs in *s*'s brain, then *s* will decide to push a given button.

Here, whenever a specific pattern of neural activity happens in a subject's brain, a specific decision results, namely, a decision to push a given button. It should be clear that we could generate a potentially infinite number of statements of local determination like LD1.

Statements like LD1, if true, can have an impact on the sort of libertarian free will that we have been examining. Consider Chisholm's case. If an action is to be free in his libertarian sense, then the agent has to be able to do and choose otherwise. By this criterion, and given

2 This is a modified and simplified version of an analysis of causal laws developed by Davidson (1967, p. 158).

LD1, if a pattern of neural activity of type B occurs in a subject's brain, then, in this particular situation, this subject would be unable to choose otherwise.[3] Consequently, an action resulting from such a decision would not be free in Chisholm's sense. Additionally, the more decisions happened to be determined according to that sort of law, the less would be the space for choices and actions that are free in his libertarian sense.

The impact of statements of local determination on Kane's account is more subtle. As we have seen, he only requires SFAs to be such that the agent could have done and chosen them otherwise. On his account, if a pattern of neural activity of type B occurs in a subject's brain and determines a particular behavior according to LD1, this does not entail that the action is not free in a libertarian sense, but merely that it is not an SFA. A free action or choice *can* be deterministically caused on Kanes's account, provided that the causal chain originated in a past SFA (see Kane, 2009, pp. 271-272). Thus, the truth of LD1 would not directly shrink the number of actions resulting from libertarian free will, but only the number of SFAs. But this still allows that the discovery of more and more laws similar to LD1 could decrease our confidence in the existence of SFAs, or at least challenge those who believe in their existence to provide some evidence. For if many choices could be shown to occur deterministically, then it would be natural to ask whether libertarians can support their claim that there is a special class of decisions that are not so determined.

In addition to statements of local determination, we might have a thesis about the deterministic nature of choices in general that would conflict with libertarian free will in a more radical way. Such a thesis is far more demanding than individual statements of local determination, but still far less demanding than universal determinism. We can express it in the following way:

DNC. For any subject *s*, any choice *x*, and any course of action *X*, if *s* chooses to do *X*, then there is a previous event *y* of a type *Y* in *s*'s brain, such that whenever an event of type *Y* occurs in someone's brain, then this subject will choose for the course of action *X*.

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3 Strictly speaking, the subject would be unable not to choose to push the given button. The *logical* possibility (whatever its empirical plausibility) remains that the subject could make simultaneously other, unrelated decisions. What is usually taken to be relevant in the free will debate, however, is the possibility of *not* choosing in a particular way. For example, it could be that the murderer in Chisholm's example could choose *both* to shoot and to shoot with a black (rather than, say, a gray) gun. But this additional choice would not make the shooting free on his account. The relevant possibility for free will would still be that of *not* choosing to shoot.

DNC basically says that every choice occurs according to some statement of local determination. For assume that DNC is true, and that a given subject decided to push a given right button. Then, according to DNC, there would be a previous event of a type (say, of type P) in the subject's brain that is such that any subject in whose brain an event of type P occurred would also decide to push a given right button. But this is to say that there is a statement of local determination about choices of this kind. DNC thus generalizes the idea of statements of local determination by saying that all decisions are determined according to one such statement.

Now, what would be the impact of DNC on Chisholm's and Kane's accounts? Once DNC entails that every choice is determined according to statements of local determination, it follows that if DNC is true, then there are no decisions that are free in the libertarian senses of both Chisholm and Kane. As we have seen, in Chisholm's account a decision and the corresponding action are free only if the decision is not determined. And even though determined actions and decisions can be free on Kane's account—provided that they originated in a previous SFA that was not determined—DNC entails that there are no SFAs. Therefore, DNC would completely undermine the existence of libertarian free will even in Kane's sense.

The result from the discussion so far is that, contrary to the suggestions by Nahmias and Roskies, deterministic statements less demanding than universal determinism can also threaten libertarian free will. And it seems clear that sciences other than fundamental physics, such as neuroscience and psychology, could in principle support those deterministic statements. In the case of statements of local determination, LD1 itself suggests this, since I have deliberately designed it to resemble the results reported by Soon et al. (2008). As for DNC, neuroscience and psychology should also be able to support it, since it is just a generalization about statements of local determination and choices. Despite these possibilities, what has been said is not meant to suggest that it would be easy to discover whether specific brain areas and patterns of neural activity in fact determine specific kinds of choices. Despite great progress in the study of neural and behavioral aspects involved in making decisions, much remains to be discovered on these matters (see Balleine, 2007; Dayan 2012; Glimcher, 2005, 2013; Gold & Shadlen 2007; Murray, O'Doherty & Schoenbaum 2007; Symmonds & Dolan 2012). The point here is just that we have no reason to think that neuroscience and psychology could not, in principle, find evidence supporting the relevant deterministic statements about decisions. The next section concentrates on the question whether Libet-style experiments have already, as a matter of fact, established some statement of local determination.

4 Libet-style experiments and statements of local determination

The question now is whether results from Libet-style experiments support some deterministic claim that potentially threatens libertarian free will. I will argue that they do not. The argument is based on the claim that results currently available are insufficient to establish even such weaker deterministic statements as LD1. If this is correct, we are even further away from establishing the stronger DNC.

In order to interpret Libet's original results in the light of LD1, we can propose something like this:

LDL. For any event *x*, and any subject *s*, if an *x* that is an RP-II occurs in *s*'s brain, then *s* will decide to flex his/her finger "now" and move his/her finger.

If LDL is true, we can say that readiness potentials of type II determine a peculiar sort of choice, namely, choices to "move now" that are accompanied by actual movement. However, the results fall short of definitely establishing the truth of LDL. Libet measured the time lapse between voluntary movement and RP onset by averaging the EEG signal recorded from 1.4 seconds before finger movements (Libet et al. 1982, p. 324; see also Haynes, 2011, p. 86; Pockett & Purdy, 2011, pp. 35-37; and the commentary following Libet, 1985). Only data within this time interval was actually stored and analyzed. That means that, due to its very design, Libet's original experiment could not find an RP-II that is *not* followed by a decision to "flex now," and by actual movement. But this is critical for assessing the truth of LDL. The only way to falsify it is by finding an RP-II that is not followed by a decision to "flex now." Therefore, Libet's results support in fact the claim that some RPs of type II are followed by decisions to "flex now," rather than the stronger LDL. In other words, Libet's results leave it open whether RP-II determines decisions to "flex now," or if it is just something that precedes the sort of action investigated, but that could also precede other sorts of actions and states.[4]

Consider now the experiments by Soon et al. (2008). Here subjects were asked to choose between a left and a right button, press it immediately after deciding for one of them,

4 Pockett and Purdy (2011, pp. 36–37) say that "Waveforms that look like RPs have been known for decades to occur before a variety of expected events that are not movements." This suggests that RPs in fact are not uniquely related to decisions to "flex now". It should also be mentioned that Libet's experiments on 'veto' conditions—when subjects were instructed to prepare to move at a prearranged time and, shortly before, block that preparation—indicated that a great initial portion of an RP of *type I* may not be followed by actual movement (see Libet, 1985, pp. 537-538, especially Figure 2).

and then report the time of the decision. During this process their brain activity was scanned with fMRI. Using advanced decoding techniques, the authors were able to show that the spatial pattern of activation is some brain regions (e.g. BA10 in frontopolar cortex) contained predictive information about which button the subject would choose and actually press. This information was available in the brain at about 7-10 seconds before the time subjects reported to have consciously decided, and it predicted the result with nearly 60 % accuracy (see Soon et al., 2008, p. 544, figure 2). In more precise terms, the authors were able to identify some patterns of neural activity whose occurrence indicated that a particular decision would follow with a probability of approximately 60 %—when the chance probability is 50 %.

We could also try to infer something similar to LD1 here. We would get a statement of local determination whose antecedent specifies some pattern of neural activity, and whose consequent specifies a particular choice accompanied by behavior (pressing a right or a left button). As in Libet's case, the study excludes from the start the possibility of identifying those same patterns of neural activity in situations that are not followed by decisions and movements of the types under investigation. But here the possibility of inferring a deterministic statement is even smaller (indeed null). Since the accuracy is of just 60 %, it follows that in approximately 40 % of cases those patterns of neural activity were followed by a different decision than the one to be expected. For the sake of argument, name "XYR" a pattern of neural activity whose occurrence raises the probability of a decision to push the right button to 60 %. Given that the right-button and left-button options are mutually exclusive, it follows that we should expect XYR neural activity to be followed by decisions to press the *left* button in approximately 40 % of cases. That means that in some occasions XYR neural activity is *not* followed by decisions to push a right button. Therefore, a statement of local determination with the occurrence of XYR as its antecedent and the occurrence of a decision to press the right button as its consequent would be false. Of course, it remains an open question whether future studies could improve accuracy and reveal whether we are facing deterministic processes still poorly known, or processes that are intrinsically stochastic (see Haynes, 2011, p. 93). Either way—and this is the important point here—we are far from having established a deterministic claim that could conflict with libertarian conceptions of free will.

The previous arguments suggest that Libet-style experiments have not so far provided results that could undermine libertarian free will, although neuroscience and psychology more generally could in principle do that. Could Libet-style experiments themselves some day af-

fect libertarian free will? A first step in answering this question is to flesh out what possible result from a Libet-style experiment would lend support to a statement of local determination. The key difficulty, as we have seen, is to establish that some sort of neural activity occurs *exclusively* in situations that are followed by a particular sort of decision—as contrasted, for example, with establishing that a particular sort of decision is always preceded by some sort of neural activity. There are technical difficulties here. In the case of type-II RPs, one needs a reference point on the basis of which EEG recordings from many trials can be averaged. This makes it difficult, practically, to investigate if RPs that are candidates for determinants of specific decisions can appear without the expected decisions and movements (see Libet, 1985, p. 538; Gomes, 1999, p. 64). But practical difficulty does not mean impossibility. One possibility would be to add some form of intervention to Libet-style experiments that induced RPs whose effects could then be analyzed. Additionally, one could have a comparison between intervention and control conditions—a methodology widely used in attempts to infer causal connections. In the case of Soon et al. (2008), a first and crucial limitation is the low accuracy of predictions: we do not have at present a plausible candidate for neural determinant of a particular sort of decision.

What are the prospects for future investigations? Haynes himself (2011, p. 94) has suggested developing a "decision prediction" machine for predicting choices in individual trials in real time. This would allow conducting some relevant experiments. For example, if one could predict the decisions subjects are going to make in real time, "one could ask them to change their mind and take the *opposite* option" (p. 94). It could then be assessed whether some candidate for neural determinant of a particular sort of decision is always followed by the expected decision.

Results currently available, moreover, suggest that this sort of experiment could be implemented in the near future. For example, some studies have achieved higher accuracies in the prediction of choices from neural events, even on a single-trial basis and even in real time. Maoz, Ross, Ye, Mamelak and Koch (2012) were able to determine in real time from intracranial recordings which hand subjects would raise half a second before a "go" signal. They achieved accuracies above 68 %. Similarly, Salvaris and Haggard (2014) used EEG signals to predict in real time whether subjects would follow or not a given instruction. They achieved approximately 75 % near the "go" signal. Curiously, this is significantly less than the accuracy achieved in conditions in which subjects were asked just to follow a given instruction

(approximately 82%; see Salvaris & Haggard, 2014, p. 8, figure 7). The authors themselves interpreted this as suggesting that free actions are less predictable because agents "could have done otherwise" (Salvaris & Haggard, 2014, p. 10). At any rate, despite the increase in accuracy, both Maoz et al. (2012) and Salvaris and Haggard (2014) failed to measure the *time* of subjects' decisions (for difficulties involved in this task, see Banks & Isham, 2011 and Maoz, Mudrik, Rivlin, Ross, Mamelak et al., 2015). This is a shortcoming for the present purposes because we cannot know if the information decoded was predictive of a *forthcoming* choice. In contrast, Fried, Mukamel and Kreiman (2011) have monitored the time of a conscious decision between left and right hand in a similar experiment, but accuracy remained below 70 % before the time of decision (see figure S7E, supplemental information). This again supports the idea that neuroscience *could* provide evidence for deterministic statements that would conflict with libertarian free will, although that evidence has not been provided so far.

5 Conclusion

There has been divergence about the significance of Libet-style experiments for discussions about free will. In what concerns specifically libertarian free will, it turns out that parties have drawn exaggerated conclusions. Contrary to what one side has defended (e.g. Nahmias, 2014b; Roskies, 2006; Sinnott-Armstrong, 2011), experiments in neuroscience and psychology could, in principle, support deterministic statements that undermine libertarian free will. But, contrary to what those in the opposite side have insisted (e.g. Misirlisoy & Haggard 2014; Haynes, 2011), results so far obtained fall short of actually supporting even those weaker statements of local determination. Assumptions involving libertarian free will are often in place in discussions about free will and neuroscience. First, because libertarianism is a more demanding view, both metaphysically and empirically, some have assumed that if science leaves space for free will at all, then it must be for some weaker, compatibilist sort of free will (see, e.g., Koch, 2012, p. 111; Schlosser 2012). This, together with a second assumption that libertarianism is the correct view (or that it better represents laypersons' views), has also lead some to conclude that neuroscience shows that free will (in itself, or in the way it is commonly understood) is an illusion (e.g., Haynes, 2011; Misirlisoy & Haggard, 2014, p. 37; Harris, 2012, p. 16).[5] If the present results are correct, data from Libet-style experiments lend

5 As I have noted earlier, controversies remain in the philosophical debate on compatibilism versus incompatibilism, as well as in the experimental research on laypersons' beliefs about free will. On the latter, see, for example, Nahmias, Morris, Nadelhoffer & Turner (2006), Nahmias, Coates & Kvaran (2007), Nichols & Knobe (2007), Rose & Nichols (2013), Deery, Davis & Carey (2014), Feltz & Cova

support to none of those assumptions, although they (as well as other studies in neuroscience and psychology) could in principle do that.[6]

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(2014), Nahmias (2014a), and Andow & Cova (forthcoming).

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