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 determinist claims that would equally 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) establish such less demanding determinist 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: free will, libertarianism, Benjamin Libet, 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, Wright, Feinstein & Pearl, 1982; Libet, Gleason, Wright & Pearl, 1983; 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 become conscious of wanting 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 examination are initiated unconsciously in the brain. More recently, Soon, Brass, Heize & 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 is of no more than approximately 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 2.) Below, I start by framing current disputes on the impact of Libet-style experiments on libertarian free will (Section 1), 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 determinist claims that might threaten libertarian free will (Section 2). The second is that Libet-style experiments have not so far established that sort of claim, though they could in principle (Section 3). Neuroscience and psychology could in principle undermine libertarian free will, but Libet-style experiments have not yet done that.

1. 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, one of the authors 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 conscious 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 ascribed to common thought. 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, remarkably in philosophy. Nahmias 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. (Nahmias, 2014, p. 5)

He then analyzes a group of candidates for 'X', the first of which is 'determinism'. He

gets the following argument (see Nahmias, 2014, p. 5):

1. Free will requires that determinism is not the case.
2. Science is showing that determinism is the case (for humans).
3. 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 incompatibilists:

> 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. (Nahmias, 2014, 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, 2014, p. 6, author's emphasis).

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 determinist 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" (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, Morris, Nadelhoffer & Turner, 2006; Nahmias, Coates & Kvaran, 2007; see Nichols & Knobe, 2007, for a contrary view). 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 conception 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.

2. 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 among 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 *all* events in the universe—including, of course, human decisions and actions—are caused by

previous events in accordance with laws of nature. For the purposes of this paper, I will ignore if neuroscience can support determinism so defined. I want to ask instead if there is a more modest form of determinism that is both (a) sufficient for undermining libertarian free will, and (b) supportable, at least in principle, by neuroscience. I claim that there is, 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 someone acts freely only if she could have done otherwise. But he rejects a (compatibilist) conditional analysis of 'could have done otherwise', that is, an interpretation in which 'she could have done otherwise' means that 'she would have done otherwise *if* she 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 'she could have done otherwise' requires 'she 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. (Chisholm, 1964, p. 175-176, author's emphasis)

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*)… (Kane, 2009, p. 275, author's emphasis)

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. In contrast with Chisholm, 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). 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 according on the basis of 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. Instead of a single statement that every possible event is determined, for example, 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 *x* is *P*, then *x* causes another event, *y*, that is *Q*.[2]

LD says that whenever there is an event of sort P, that event causes a second event of sort Q, i.e., events of sort P *deterministically* cause events of sort Q. We can imagine a similar law that would prevent an individual to choose otherwise given some previous event whose occurrence was not within her control:

> LD1: For any event *x*, and any subject *s*, if *x* is a pattern of neural activity of type B in *s*'s brain, then *x* causes *s* to 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, 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 are such that, were they true, they could undermine 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 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 a libertarian sense.

The situation is more complex in Kane's account, but not radically distinct. 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 happens in a subject's brain, causing him to behave according to LD1, this does not entail that the action is not free in a libertarian sense, but merely that it is not a SFA. A free action or choice *can* be deterministically caused on Kanes's account, provided that the causal chain ends in a SFA (see Kane, 2009, p. 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, and, indirectly, decrease our confidence in the existence of libertarian free will.

The result from the discussion so far is that, contrary to the suggestions by Nahmias and Roskies, determinist statements less demanding than universal determinism can equally threaten libertarian free will. And it seems clear that sciences other than fundamental physics, such as neuroscience and psychology, could in principle support statements of local determination similar to LD1. LD1 itself suggests this, since I have deliberately designed it to resemble the results reported by Soon et al. (2008). And there is no reason to think that neuroscience and psychology could not, in principle, find evidence supporting claims of that sort. We can now consider whether Libet-style experiments have already, as a matter of fact, established some statement of local determination.

3. Libet-Style Experiments and Statements of Local Determination

The question now is whether results from Libet-style experiments support some determinist claim that potentially threatens libertarian free will. I will argue that they do not. The results currently available are insufficient to establish even such weaker determinist statements as LD1.

If we try to interpret Libet's original results in the light of LD1, we get something like this:

> LDL: For any event *x*, and any subject *s*, if *x* is a RP-II in *s*'s brain, then *x* causes *s* to decide to flex his/her finger "now" and to 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). Only data within this time interval was actually stored and analyzed. That means that, due to its very design, Libet's original experiments 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 is a deterministic cause of 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, 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 spacial 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, Fig. 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 determinist 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 rises 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 surely false. Of course, it remains an open question whether future studies could improve accuracy, that is, whether we are facing determinist 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 determinist claim that could conflict with libertarian conceptions of free will.

The previous arguments suggest that Libet-style experiments have so far provided no result that could undermine libertarian free will, although neuroscience and psychology more generally could in principle do that. Could Libet-style experiments themselves some day affect libertarian free will? In order to answer this question, we need 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 happens exclusively in situations that are followed by a particular sort of decision. 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 deterministic causes of specific decisions can appear without the expected effect (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. I think the same strategy could possibly be employed with the experiments by Soon et al. (2008). As we have seen, however, we face here the preliminary issue that we do not have at present a plausible candidate for determinist cause of decisions that could be tested. Again, this only suggests difficulties of a practical order and the absence of established threats to libertarian free will, but not a principled impossibility.

Conclusion

There has been divergence about the significance of Libet-style experiments for discussions about free will. In what concerns specifically libertarian free will, my conclusion is that parties have drawn exaggerated conclusions. Contrary to what one side has defended (e.g. Roskies, 2006; Nahmias, 2014; Sinnott-Armstrong, 2011), experiments in neuroscience and psychology could, in principle, support determinist statements that could 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; Harris, 2012, p. 16; Misirlisoy & Haggard, 2014, p. 37).[5] If the present results are correct, data from Libet-style experiments lend support to none of those assumptions, although they (as well as other studies in neuroscience and psychology) could in principle do that.

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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. (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). Questions related to the latter point include the representativeness and significance of finger flexings for free will, the precise nature of the mental phenomena investigated, and various others (see, e.g., Mele, 2006, 2009, the essays in Sinnott-Armstrong & Nadel, 2011, and in Part II of Pockett, Banks & Gallagher, 2006, as well as most of what is discussed below).

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

[3] Strictly speaking, the subject would be unable not to choose to push a 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.

[4] Pockett and Purdy (2011, p. 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, p. 537-538, especially Figure 2).

[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), and Nichols & Knobe (2007).