

New chapter opens in free will debate

Anil Ananthaswamy

ADVOCATES of free will can rest easy, for now. A 30-year-old classic experiment that is often used to argue against free will might have been misinterpreted.

In the early 1980s, Benjamin Libet at the University of California in San Francisco, used electroencephalography (EEG) to record the brain activity of volunteers who had been told to make a spontaneous movement. With the help of a precise timer that the volunteers were asked to read at the moment they became aware of the urge to act, Libet found there was a 200 millisecond delay, on average, between this urge and the movement itself.

But the EEG recordings also revealed a signal that appeared in the brain even earlier – 550 milliseconds, on average – before the action. Called the readiness potential, this has been interpreted as a blow to free will, as it suggests that the brain prepares to act well before we are conscious of the urge to move.

This conclusion assumes that the readiness potential is the signature of the brain planning and preparing to move. “Even people who have been critical of Libet’s work, by and large, haven’t challenged that assumption,” says Aaron Schurger of the National Institute of Health and Medical Research in Saclay, France.

One attempt to do so came in 2009. Judy Trevena and Jeff Miller of the University of Otago in Dunedin, New Zealand, asked volunteers to decide, after hearing a tone, whether or not to tap on a keyboard. The readiness potential was present regardless of their decision, suggesting that it did not represent the brain preparing to move. Exactly what it did

mean, though, still wasn’t clear.

Now, Schurger and colleagues have an explanation. They began by posing a question: how does the brain decide to make a spontaneous movement? They looked to other decision-making scenarios for clues. Previous studies have shown that when we have to make a decision based on visual input, assemblies of neurons start accumulating visual evidence in favour of the various possible outcomes. A decision is triggered when the evidence favouring one particular outcome becomes strong enough to tip its associated assembly of neurons across a threshold.

Schurger’s team hypothesised that something similar happens in the brain during the Libet

experiment. Volunteers, however, are specifically asked to ignore any external information before they make a spontaneous movement, so the trigger to act must be internal.

The random fluctuations of neural activity in the brain might provide that trigger, encouraging movement when this noise accumulates to a threshold level.

The team constructed a

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computer model of this neural activity to probe the idea. Each time the neural noise crossed a certain threshold it signified a decision to move. The team found that the pattern of the neural noise leading up to the decision, averaged over multiple trials, looked like a readiness potential.

To test the idea further, the team repeated Libet’s experiment,

but this time if, while waiting to act spontaneously, the volunteers heard a click they had to act immediately. The team predicted that the fastest response to the click would be seen in those in whom the accumulation of neural noise had neared the threshold – meaning their brains were about to commit to a movement. This build-up of noise would show up as a readiness potential.

This is exactly what they found. Also, in those with slower responses to the click, the readiness potential was absent in the EEG recordings (*Proceedings of the National Academy of Sciences*, DOI: 10.1073.pnas.1210467109).

“Libet argued that our brain has already decided to move well before we have a conscious intention to move,” says Schurger. “We have argued that what looks like a pre-conscious decision process may not in fact reflect a decision at all. It only looks that way because of the nature of spontaneous brain activity.”

So what does this say about free will? “If we are correct, then the Libet experiment does not count as evidence against the possibility of conscious will,” says Schurger.

Cognitive neuroscientist Anil Seth of the University of Sussex in Brighton, UK, is impressed by the work, but also circumspect about what it says about free will. “It’s a more satisfying mechanistic explanation of the readiness potential. But it doesn’t bounce conscious free will suddenly back into the picture,” he says. “Showing that one aspect of the Libet experiment can be open to interpretation does not mean that all arguments against conscious free will need to be ejected.”

According to Seth, when the volunteers in Libet’s experiment said they felt an urge to act, that urge is an experience, similar to an experience of smell or taste. The new model is “opening the door towards a richer understanding of the neural basis of the conscious experience of volition”, he says. ■



JANNIS GLASGETTY

Do they have free will?