

## **Predicting your decision while you make up your mind – an intracranial human study of the neural underpinning of decision making**

### **ABSTRACT:**

Humans typically experience decisions like donating to charity or going on vacation as inherently up to them and thus entailing responsibility. However, recent results in neuroscience – Libet results – purportedly suggesting that predictive information about upcoming decisions exists in the brain well before subjects report deciding. Some have thus deduced that all decisions are made unconsciously and free will and moral responsibility are illusory.

However, the above experiments typically focused on arbitrary decisions – bearing no meaning consequence or purpose – while the free will debate focuses on deliberate decisions. We worked with patients implanted with intracranial electrodes for clinical purposes and with EEG subjects to elucidate the neural precursors of arbitrary and deliberate decisions. In particular, we were interested in predicting action contents before action onset online and in real time. In a more philosophical vein, we also investigated the potential ethical and legal repercussions of the Libet results.

We found that arbitrary decisions can be predicted earlier and at a higher accuracy than deliberate ones. In addition, the readiness potential, a precursor of movement on which much of the Libet paradigm relies, is much more apparent for arbitrary than deliberate decisions. We further demonstrated that, even at face value, the Libet results have little bearing on moral and criminal responsibility and debate their use in the “my brain made me do it” legal defence.

We therefore conclude that, at least at this time, drawing strong conclusions from the Libet and similar experiments about lack of free will or moral responsibility is, at best, too hasty.

### **Keywords**

Decision-making, Free will, Moral responsibility, Volition, Action prediction

### **Published Work:**

Mudrik, L., & Maoz, U. (2015). “Me & My Brain”: Exposing Neuroscience's Closet Dualism. *Journal of Cognitive Neuroscience*, 27(2), 211-221. doi: 10.1162/jocn\_a\_00723

Maoz, U., Mudrik, L., Rivlin, R., Ross, I., & Mamelak, A. (2015). On reporting the onset of the intention to move. In A. Mele (Ed.), *Surrounding Free Will*. Oxford University Press. doi: 10.1093/acprof:oso/9780199333950.003.0010

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Maoz, U., & Yaffe, G. (2015). What does recent neuroscience tell us about criminal responsibility? *Journal of Law and the Biosciences*, 3(1), 120-139. doi:10.1093/jlb/lsv051

Maoz, U., & Flash, T. (2014). Spatial constant equi-affine speed and motion perception. *Journal of Neurophysiology*, 111(2), 336-349. doi: 10.1152/jn.01071.2012

Maoz, U., & Yaffe, G. (2014). Cognitive Neuroscience and Criminal Responsibility. In M. Gazzaniga & G. Mangun (Ed.), *Cognitive Neuroscience: The Biology of the Mind* (pp. 1025-1033, 5th ed.). Cambridge, MA: MIT Press.

Maoz, U., Rutishauser, U., Kim, S., Cai, X., Lee, D., & Koch, C. (2013). Predeliberation activity in prefrontal cortex and striatum and the prediction of subsequent value judgment, *Frontiers in Neuroscience*, 7:225. doi: 10.3389/fnins.2013.00225

### **Researcher's Contacts:**

Uri Maoz

Address: 10777 Massachusetts Ave, Los Angeles, CA, 90024

Phone: +1-626-808-6412

Fax: +1-310-206-5895

Email: urim@caltech.edu