To What Extent Is Free Will Actually Free? The Answer of Neurosciences

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Abstract

Even though at the beginning of the 1980s the results of the first neuroscience experiments made some researchers label free will as an "illusion", researches of recent years have unexpectedly changed this perspective. It is raised the issue of post-classical, post-dualistic views in which free will can no longer be regarded as an "all-or-nothing" phenomenon, and in which freedom itself is paradoxically redefined as an unconscious predetermination out of an infinite number of options. The present paper summarizes the perspectives on free will generated by the first experiments in neuroscience and aims to find an answer regarding the freedom of choice, taking into account the latest scientific communications on this subject.

Keywords: free will, neuroscience, consciousness.

1. Introduction

Are we responsible of our own decisions or are they predetermined? Science, philosophy, religion have tried to answer this question over time. Although we are provided with a certain psychological comfort when we believe we have complete control over our choices, it is still interesting to analyze the oppposite situation as well, from the point of view of the social and individual impact it has. All the more so, since the findings of the neurosciences on freedom of choice have come to transform the simple interest or curiosity into a reconfigured, not necessarily comfortable, way of perceiving the world. As Prof. Joaquin Fuster affirmed, "One of the most interesting directions of development in western culture is the convergence of philosophical thinking with neuroscience on the subject of free will."

2. Between Faith and Illusion

A series of studies initiated more than 30 years ago by Benjamin Libet (Libet, Gleason, Wright and Pearl, 1983) provided evidence that the perceived freedom of will may be an illusion. Since then, analyses have continued providing arguments for and against this idea.
Freedom has always been percieved as a state opposing constraints of any kind. This perspective seems to set apart two categories of free will theorists. On the one hand, the advocates of faith in relation to the freedom of human will - many philosophers and theologians, present the construct as a human gift necessary for a moral conduct.

> "There are those who, in their moral fervour, label anyone a man of limited intelligence who can deny so patent a fact as freedom. Opposed to them are others who regard it as the acme of unscientific thinking for anyone to believe that the uniformity of natural law is broken in the sphere of human action and thought. One and the same thing is thus proclaimed, now as the most precious possession of humanity, now as its most fatal illusion." - a fragment from "The Philosophy of Freedom" - Rudolf Steiner

There were also philosophers who had a vision similar to what neuroscientists say nowadays. For example, Nietzsche had asserted since the nineteenth century that the man lives in an illusion by believing in free will, while in reality everything comes down to necessity, determinism, mathematical calculus.

Research into cognitive neuroscience provides results which lean towards characterizing this concept as an "illusion". Free will being an illusion created by the human mind is, of course, not the most comfortable scenario for the human race. Do neurosciences make us choose between

metaphysics and science before making the concept of free will incompatible with the scientific method? (Anderson, J., 2007). How willing are we to accept and live with such a verdict? How do we get to understand what "Big Bad Neuroscience" offers?

3. Early Beginnings: The Libet Experiment

In Libet's experiments at the end of the 1970s and early 1980s, volunteers sat down with a button and a clock in front of them. They could decide to press the button at any time, and Libet asked them to check the time in the moment they made the decision to press it. The volunteers had several electrodes attached to their scalp so as to observe the neuronal cortex activity on the EEG. By recording the reaction time and comparing the time of pushing the button with the one in which the volunteers decided to press the button, Libet's team found that the difference between the conscious decision of pushing the button and the event itself was about 200 milliseconds. Analyzing the EEG result, Libet was surprised to discover that the brain area associated with motion initiation became active 500 milliseconds before pushing the button. Therefore, the brain became active 300 milliseconds before the moment of the conscious decision to press the button. The experiment was interpreted by the scientific world as the first demonstration that free will is an illusion.

Numerous other researchers (John Dylan Haynes, Marcus Du Sautoy, Patrick Haggard) have repeated Libet's experiment, observing even longer periods between the onset of brain activity and the moment of conscious decision. For example, a study carried out in 2008 by researchers at the Max Planck Institute in Leipzig showed that decisions can be detected even 7 seconds before the moment a person becomes aware of them. The replication research of these experiments came to the same conclusion, namely that the mind takes command before the protagonist reaches a conscious decision, so decisions are made earlier than previously thought.

Some authors claim that scientific experiments, starting with Libet's and the others that followed, did not provide consistent conclusions, and therefore became irrelevant due to fundamental deficiencies (Papanicolau, A., 2017). Although they are believed to shape significant acts of will, in fact, all they do is shape inconsistent movements. Although these movements have been shown to be preceded by or associated with neural events, these events can not be regarded as causes of the experience of free decisions more than other antecedents or correlations of other psychological events occurring simultaneously".

In response to that, other authors introduce the concept of **methodological determinism** and insist on questioning the scientific state of the concept of free will, adding that the statement on "determining behavior through free will" is not falsifiable (in the sense of the criterion introduced by Popper). Therefore, we would speak in this case of a metaphysical statement and not of a scientific hypothesis.

> "Men are mistaken in thinking themselves free; their opinion is made up of consciousness of their own actions, and ignorance of the causes by which they are conditioned. Their idea of freedom, therefore, is simply their ignorance of any cause for their actions. As for saying that human actions depend on the will, this is a mere phrase without any idea to correspond thereto". (Spinoza, The Ethics Part II: Of the Nature and Origin of the Mind (partially quoted by Daniel Wegner (1948-2013)

4. Free Will and Quantum Physics

For decades, a topic of great interest is the possible existence of a quantum substrate of human consciousness. There was, as expected, a fusion of two seemingly unrelated directions - on the one hand, the quantum level of physics, and on the other hand, the human consciousness. The idea of a human consciousness with a quantum substrate has thus, in recent years, taken up a whole part of the literature.

Henry Stapp, a promoter of the quantum theory of consciousness, provides an explanation of the concept of free will, from the area of "orthodox quantum mechanics". The author, a distinguished theoretical physicist, shows how this theory, interpreted in a realistic way, assigns an important role to our free conscious choices. Stapp argues that biology and neuroscience, despite

nearly a century of quantum physics, remain the slaves of some classical failed precepts, in which mental intentions have no effect on our physical actions. He indicates how quantum mechanics provides a rational basis for a better understanding of this connection. These ideas have major implications for our understanding of ourselves and our mental processes, and thus for the significance of our lives.
Ideas are carried further by Roger Penrose and Stuart Hameroff in "Consciousness in the Universe: Neuroscience, Quantum Space-Time Geometry and Orch OR Theory." On the other hand, physicists like David Chalmers and Victor J. Stenger argue against the idea of a quantum consciousness. This is a debate from which we have a lot to learn, no matter how it evolves.

It is certain that in this paradigm of quantum consciousness, psychology reached some kind of a dead-end in its concern for the study of consciousness. The method of observation is invalidated in explaining the facts of consciousness, including free will, in the case of a quantum substratum. The reasons were put forward by Bohr and Heisenberg who demonstrated that objective observations can not be made, as the action of observing alters the quantum state of the observed system. However, the observer effect is not the only drawback; at the instrumental and methodological level, psychology is deficient in providing on its own a conclusion in the debate of the existence of free will.

5. No Wonder that Researches Led to Neurosciences Instead

"Neuroscience, not philosophy or physics determinism, is the right science to solve disputes over free will," says Professor W. R. Klemm, a neuroscientist, in his book "Making a Scientific Case for Conscious Agency and Free Will." Klemm presents a series of arguments according to which certain human behaviors are impossible to explain in the absence of free will, and free will results from the material processes of brain function.

The idea is developed by Dr. Eric Racine, who suggests a dynamic concept for free will, which should be ontologically and epistemologically rethought. His suggestion starts from the debate bestirred by recent research in cognitive science and social psychology which suggests that free will as a concept can describe a psychological phenomenon with interesting dynamic and implicit properties. The dynamic properties may indicate possible changes to free will in response to internal (physiological) and external (physical and social) questions. For example, research suggests that the phenomenon of free will is not static, but shaped by the physiological needs and external demands (Rigoni et al., 2011, 2012, 2013, 2015). Such free-will properties could explain the fact that changes in the dynamics of free will have implications such as acknowledging that a diminished free will may lead to unethical behaviors, for example deception (Vohs & Schooler, 2008), while a strong free will may predict pro-social behavior and work performance (Baumeister et al., 2009; Stillman et al., 2010).

“The evidence for conscious causation of behavior is …empirically strong. However, conscious causation is often indirect and delayed, and it depends on the interplay with unconscious processes” (Roy Baumeister).

6. Challenging Experiments

In 2007, John-Dylan Haynes, a neurologist from Berlin, discovered by using fMRI imaging that he could predict with a 60% accuracy whether a subject would press the left or right button, with up to 7 seconds before the person pressed it and 6 seconds before he/she "chose" which button to press. Kerri Smith, editor for the Nature magazine, affirmed this about a 2011 study: "Some researchers have literally dug deeper into the brain." One of them is Itzhak Fried, neurologist and neurosurgeon at the University of California, Los Angeles and the Medical Center from Tel Aviv, Israel. He studied individuals who had electrodes implanted in the brain, as part of a surgical procedure for treating epilepsy. Fried's experiments have shown that there was activity in the individual neurons in certain areas of the brain about one and a half seconds before the subject made a conscious decision to press a button. "At some point, things that are predetermined are

accepted into consciousness," says Fried. Conscious will may be added to a decision at a later stage, he suggests.

7. Explanations of Neurosciences

Frankfurt and Dennett propose **Compatibility**, claiming that free will and determinism are compatible. Determinism had, up to that moment, a position contrary to modern neurosciences in several respects related to the complexity, variance, nonlinearity and probabilistic nature of neural transfers, especially those related to psychological phenomena. Frankfurt argues that, under certain conditions, conflicts may appear between a person's desire to do an action and a desire not to do so. The neural explanation of the conflict lies in the prefrontal mechanisms of reward search vs. the inhibitory control of the impulse. Dennet, on the other hand, anchors the concept of free will in evolution, for example in altruism (manifested as a free will to help others) and attributes it to an evolutionary pressure of selection. Dennet also develops the idea towards the gradual evolution of decision-making.

Fuster noticed the problem of the 2-stage decision-making models, which lies in the fact that they are based on feed-forward processing (in the direction of time) with minimal feed-back and little room for a chance to change. As a result, Fuster proposes a cyclical model in *which an action and the decision that has led to it can begin and can be completed anywhere within the perception-action cycle.* Within this framework, free will arises from the close relationship between the brain and the environment within this cycle, and the environment is largely internal, containing representations of the world, an internalized history in the cerebral cortex. The key thus reaches the prefrontal cortex because probably "among the degrees of freedom of the statistical variation in the cortex there is hidden one of the causes of the freedom of the human mind" (Fuster). In the case of such a dynamic and complex adaptive system as the brain, variance is a *sine qua non* condition for plasticity, a emergence of new functions, and consequently, of freedom of cognition.

The interesting perspective proposed here is that*, if we have enough degrees of freedom in the brain processing loops, they would ensure a variability which in fact defines free will!*

But we must not fall into the trap of locating free will and assigning its place in the prefrontal cortex. Rather, in the dynamic dashboard described above, this is a kind of "neural broker" (Fuster) for the highest transactions between ego and the environment.

Another aspect of the analysis is that of multi-determination, based on the principle that the more causes we have, the less the constraints on freedom exist. Multidetermination opposes reductionism, which seeks an ultimate cause, ending up fragmenting concepts into parts that become irrelevant. We have to take into account that the cognitive code is a relational, nonreducible code of the component (Fuster), and as a result: "Any attempt to break the code down to its molecular biology is like trying to understand a written message by studying the chemistry of the ink"(Roger Sperry, cited by Fuster).

In conclusion, we could say that when talking about free will, from the neuroscientific point of view, we refer to the freedom of information within the cortex (to its structural units, interactions and dynamics, to all the feedback loops and the action-perception circuits). Cognitive neurosciences cause us to regard free will as a product of brain function, with a highly adaptive and complex capacity, supported by both conscious and unconscious decision-making structures. (Ibanez A. et al., 2017) We are still on the brink of approximating a definition, warns Ibanez, the author of a visionary study that overturns all of the classical outlooks of free choice. The theoretical platform that he proposes leads to new post-classical, post-ontological, post-dualist hypotheses.

The concept of free will remains hard to define especially within the continuous paradigm changing on decision making (quantum and classical, for example). One path could be searching some patterns of those moments of thinking without conscious control. Psychology has some instruments on predicting choice (also the independent ones) by integrating context and identifying some context-dependant decision patterns. Cognitive neuroscience gets some inspiration from machine learning providing with neural patterns for decisions that could actually be learned. We may have a step back in 1949 when an important theory came up – Hebb's neural learning rule. The rule

explains associative or Hebbian learning, in which simultaneous activation of cells leads to pronounced increases in synaptic strength between those cells. Even if the Hebbian theory has been mostly used in neuroplasticity studies, we consider that there is an important argument to take into free will explanation, as Hebbian learning is a real-time learning that is more easily associated with the lack of conscious control. Moving back to a different form of physical determinism, we may conclude that once the hardwired neural assemblies for different inputs are created (the decision-making contextual pattern), the algorithm can work in different modes both in presence and absence of attention. If the activation patterns (inputs) contain information about the decisions, the classifier developed into the brain can successfully predict decision outcomes from independent data and that could trigger choice that we see as volitional (free will).

The remaining challenge is how this perspective will be managed further in the increasingly interdisciplinary context of human knowledge.

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