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Neurobiology and free will: a dialogue between Mariano Artigas and John Eccles

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Abstract. In this article, I discuss the importance of multidisciplinary research to tackle the questions that empirical sciences, and in particular neuroscience, ultimately encounter. The last decades have witnessed an enormous progress in brain research, mainly because of the improvement of neuroimaging techniques and neurogenetics, and the development of optogenetics. Furthermore, the US Government and European Union have launched the BRAIN Initiative and Human Brain Project, respectively, to promote a better understanding of brain functioning and its disorders. Unfortunately, their gates appear sealed for disciplines that pursue a deep knowledge of the mind, such as philosophy or psychology. The most probable outcome of this situation is "promissory materialism", as Sir John Eccles warned several decades ago. I review the multidisciplinary approach of Eccles to the study of the brain and mind, especially through his relationship with Mariano Artigas. Finally, I propose that interdisciplinary research may be improved by a more solid understanding of the discipline one wants to dialogue with, and a multidisciplinary training from the beginning of the research career.

Keyword: interdisciplinarity; mind-brain; reductionism; free will.

Introduction: The decades of the brain

In 1990, July 17th, President George Bush designated the decade between 1990 and 1999 as the "Decade of the brain", "to enhance public awareness of the benefits to be derived from brain research". In the Presidential Proclamation 6158, Bush justifies this designation as the main way to alleviate neurological and psychiatric disorders, including addiction and genetic disorders, and leans on the spectacular advances in the field of microscopy, genetics and brain imaging (Bush 1990). This initiative was unquestionably a boost, both intellectual and economic, to promote research in neuroscience. The decade of 2000s also brought a high enthusiasm about what neuroscience was discovering or, more precisely, what would discover in the near future. For example, the prestigious magazine Scientific American highlighted the following advances in neuroscience during the decade after the "Decade of the brain" (Calderone 2014): 1) neurogenetics: the ability to diagnose neural disorders with a simple blood test; 2) brain mapping, at the level of functional and anatomical connections; 3) brain plasticity in adults; 4) grid cells in the hippocampus, also known as the "GPS" of the brain; 5) the interplay between memory and emotions; 6) the improvement of cognitive-behavior therapies for psychiatric disorders; 7) optogenetics, that is, the technique to introduce neurons sensitive to light in adult non-human animals; 8) the implication of glial cells in cognitive functions; 9) the development of neural implants; and 10) a better understanding of human decision making. But the great interest and advances in neuroscience did not stop a decade after the "Decade of the brain". As it is well known, President Obama launched in 2013 the BRAIN (Brain Research through Advancing Innovative Neurotechnologies) Initiative, which in practice involves the investment of thousands of millions in advancing neuroscience. Almost simultaneously, the European's Commission Future and Emerging Technologies Flagship announced the Human Brain Project, a multi-phase strategy "to put in place a cutting-edge, ICT-based scientific Research Infrastructure for brain research, cognitive neuroscience and brain-inspired computing". In conclusion, neuroscience is experiencing a sweet moment for the last 30 years, developing new

techniques, discovering exciting findings, and promising great advances in the study of the brain and mind. But, is that so?

One would expect that such a strong effort to understand better the neural system would entail a commensurate attempt to go deeper in the study of the mind. However, this connection is not straightforward. The main reason of this apparent imbalance is the presupposition that the study of the brain equals the study of the mind. Steve Hyman, former president of the National Institutes of Mental Health and current president of the International Neuroethics Society, stated that "Mental illnesses are real, diagnosable, treatable brain disorders" (Hyman 1998). Psychologist Gregory Miller has denounced this and other examples of scientific reductionism. In his opinion, the main problem is that "the dominant discourse in modern cognitive, affective, and clinical neuroscience assumes that we know how psychology/biology causation works when we do not" (Miller 2010). Miller's was a reaction to the main outcomes of Bush's "Decade of the brain". What can we expect about the study of the mind from the BRAIN Initiative and the Human Brain Project? At first sight, both seem somewhat discouraging at this respect. The former is explained in a 150-page document. Within it, the term "psychology" appears six times, but none as one of the fields where money will be invested in. "Mind", apart from expressions such as "bearing in mind", is present just once, in the preamble. "Philosophy", similarly, appears once in one of the subheadings ("Vision and philosophy"). Apparently, any expert or layman would accept that the study of the brain and mind should go hand in hand, and neither of the terms should be reduced to the other. Furthermore, it seems clear that psychology and philosophy are adequate disciplines to enrich our understanding of the human mind. In my opinion, as I explain below, the core of the problem is to assume that even though neuroscience, psychology and philosophy have different methodologies, they all are adequate approaches to enrich our understanding of the brain and mind. Surprisingly, however, the efforts of the American and European titanic projects are restricted to just one of these disciplines. Are we going to have adequate answers about the mind —and even the brain— with such a partial view?

1. Beyond the limits of neuroscience: The case of free will

As I mentioned above, psychologists and philosophers are getting used to be excluded from projects whose main goal is advancing in the knowledge of the brain. I believe that the communication breakdown between these approaches is worrying; furthermore, it is dramatic when one of them artificially maximizes its conclusions to phagocyte thousands of years of research in philosophy and psychology. This is the case of most interpretations about the "neurobiology of free will".

The unbiased demonstration of the inexistence of free will appears to be the ultimate goal of a materialist neuroscientist. According to the philosopher Susan Blackmore, "Many philosophers and scientists have argued that free will is an illusion. Unlike all of them, Benjamin Libet found a way to test it" (Blackmore 2007). I will not discuss Libet's experiments in detail here, although a short overview could be useful for the reader. In an article published in 1983, Libet and collaborators introduced an experiment to explore consciousness in the initiation of a voluntary action (Libet et al. 1983). Their strategy was to ask the volunteer to flex their wrist whenever he or she wanted, and record the precise time of the movement, as well as the onset of the readiness potential —the brain activity related to the movement of the hand. Additionally, subjects had to register the exact time at which they "felt the will" to move their hands. Their results showed that, in this temporal chain of events, the third was the wrist flexion, the second was the "conscious will to move", and the first was the readiness potential. In other words, the "urge to start the movement" was a by-product of brain activity. While the original results might be used to demonstrate the inexistence of free will, Libet reported in subsequent experiments that, even though the readiness potential was already initiated, there would be a possibility to consciously veto the movement (Libet 1985). These results about the conscious veto have been recently replicated with sophisticated brain-computer interface techniques (Schultze-Kraft *et al*. 2015). Libet's experiments are of great importance to inform about the brain correlates of movement preparation; however, as it has been extensively commented,

they are not about free will (see, for example, Bennett and Hacker 2003; Murillo and Giménez-Amaya 2008; Bernácer and Giménez-Amaya 2013). The main reason is that there is no "freedom" for the volunteers taking part in this experiment: after signing their informed consent, they have to be seated in the experimental room and move the hand when they are told to do it. The movement is truly self-initiated, but in a very narrow time frame —usually during the second cycle of the clock, that is, approximately between 2.5 and 5 s after starting the experiment.

In summary, many neuroscientists and some philosophers defend that free will is an illusion because the "conscious feeling to start a movement" is preceded by a consistent brain activity. This assertion entails a set of assumptions —for example: 1) the greatest expression of human free will is moving aimlessly one's hand at will; 2) there exists a "conscious feeling" to initiate a movement— which is accepted by these neuroscientists and philosophers without a deep multidisciplinary reflection. Therefore, the majority trend within neuroscience is to reduce the extreme complexity of the human *psique* to the explanatory outcome of experimental data. Given this, it does not come as a surprise that the two main initiatives to advance in the understanding of the brain exclude the human mind from their main interests.

Should we abandon any hope to give a holistic answer to ultimate humane questions such as the existence and limits of free will? In my opinion, we should not: The best strategy is to open a dialogue between disciplines with the aim of mutual enrichment. A good example of this dialogue is the conversation held by Mariano Artigas and John Eccles about the human soul, science and religion.

2. Interdisciplinarity: The dialogue within and between researchers

To the best of my knowledge, Mariano Artigas did not show a special concern about neuroscience in the course of his research. However, he was in contact with Sir John Eccles, who received the Nobel Prize in Physiology or Medicine

in 1963 for his work in postsynaptic inhibition (Eccles 1943). The harmony between their ideas is shown by the fact that Eccles wrote the prologue of Artigas' *Las fronteras del evolucionismo* (Artigas 2004). This edition of the book also includes a dialogue between both professors, whose main topics are the human soul, science and religion (Artigas and Eccles 2004). They discuss the insufficiency of scientific materialism and emergentism. Eccles proposes that phenomena from the physical world are necessary, but not sufficient, causes for the self. Furthermore, he suggests a holistic point of view to study the human *psique*, since we can have access to it from "feelings, emotions, the perception of beauty, creativity, love, friendship, moral values, thoughts, intentions… our whole world". Finally, Eccles describes science as an ethical and aesthetic effort to reach truth, and he warns about becoming an "enormous monster, feared and venerated by humans", if this description is forgotten.

The Australian neurophysiologist (1903–1997) built an extremely successful career by studying the communication between neurons, neuromuscular transmission, monosynaptic reflexes in the spinal cord, and inhibitory transmission in the cerebral cortex. Interestingly, he met Karl Popper by the end of the 1940s and was greatly impressed by his ideas about philosophy of science. After winning the Nobel Prize and close to retirement, Eccles published his first work with a philosophical nuance, *The brain and the unity of conscious experience* (Eccles 1965). Five years later, he published *Facing reality: Philosophical adventures of a brain scientist* (Eccles 1970), where he presents his dualist interpretation of the mind-brain problem. In this book, he writes the following: "As a brain scientist, I have specialist knowledge of that wonderful part of the body that is alone concerned in the whole life-long interplay between the conscious self and the external world, including other selves". He tried to overcome the dualist account by accepting Popper's description of three worlds as follows: 1) physical objects and states, including the brain; 2) states of consciousness, including the mind; 3) knowledge in objective sense, which involves all expressions of human thought. Furthermore, he calls himself an interactionist to propose a continuous interaction between the three worlds. However, he returned

to dualism in subsequent works. For example, in *The wonder of being human* (Eccles and Robinson 1984), authored together with the philosopher Daniel Robinson, he writes: "In conclusion we can say that it is of transcendent importance to recognize that by taking thought we can influence the operation of the neural mechanisms of the brain. In that way we can bring about changes in the world for good or ill. A simple metaphor is that our conscious self is in the driver's seat". In fact, in his prologue for Artigas' book (Artigas 2004), he assumes "certain Cartesian vibe".

Overall, Eccles tried to formulate and test hypotheses beyond neuroscience, struggling against scientific materialism. To do so, he tightly collaborated with philosophers such as Karl Popper or Daniel Robinson. Moreover, he underpinned these hypotheses by working together with other scientists, such as the quantum physicist Friedrich Beck. This is one of the pillars of interdisciplinary research: the ability to collaborate with researchers pertaining to other disciplines. However, in my opinion, there is a more important issue to carry out successfully this kind of research: to hold an interdisciplinary dialogue *within* oneself. At first sight Eccles also followed this path, since he was an acclaimed neurophysiologist writing about philosophy, ethics, quantum mechanics and so on. Nevertheless, his philosophical background seemed to be rather narrow by not considering alternatives to Cartesian dualism, and by eluding the problems it raises. Rather, it would have been more convenient to build a solid multidisciplinary background before going on a quest for holistic answers. In experimental research circles Eccles has been strongly criticized for his philosophical ideas —he considered himself as "heretic" within the "materialistic establishment" (Artigas and Eccles 2004)—, and he could have been heard more attentively should he had refined his philosophical position.

The last feature I would like to mention for a fruitful interdisciplinary research is to start at early stages of the career. Although Eccles was probably interested in philosophy since his youth, he only started to write multidisciplinary works after he turned sixty. In my opinion, Ph D students and postdoctoral researchers should be encouraged to transcend the limits of their disciplines and seek for objective truth beyond their fields. This

border-crossing does not only apply to experimental researchers: I believe that young researchers in philosophy would benefit from learning about empirical research and, in the case of neuroscience, the physical correlate of the mind.

Conclusions

After the announcement of the BRAIN Initiative and the Human Brain Project, it seems that the interdisciplinary dialogue between neuroscience and philosophy is going to become even more difficult than it is at present. In this context, when neuroscientists are asked about the intricacies of the mind, the most common point of view will be eliminativism. To struggle against this, it is necessary to promote an interdisciplinary dialogue, both between and *within* researchers. Sir John Eccles, collaborator with Mariano Artigas, is a good example of this approach. He was an excellent researcher in neurophysiology, awarded with the Nobel Prize, and he decided, contrary to the mainstream thought, that a philosophical reflection was needed to tackle the "hard problems" that neuroscience ultimately encounters. I suggest that neuroscientists and philosophers should follow his steps, and propose two additional ingredients to improve interdisciplinary research: a more solid understanding of the discipline one wants to dialogue with, and a multidisciplinary training from the beginning of the research career.

References

Artigas, M. 2004. *Las fronteras del evolucionismo*. Pamplona: Eunsa.

Artigas, M., and J. C. Eccles. 2004. "Alma humana, ciencia, religión." In *Las fronteras del evolucionismo*. Pamplona: Eunsa.

Bennett, M. R., and P. M. S. Hacker. 2003. *Philosophical Foundations of Neuroscience*. Oxford: Blackwell Publishing.

Bernácer, J., and J. M. Giménez-Amaya. 2013. "On Habit Learning in Neuroscience and Free Will." In *Is Science Compatible with Free Will?*, edited by A. Suarez and P. Adams, 177–193. New York: Springer. doi:10.1007/978-1-4614-5212-6.

Blackmore, S. 2007. "Mind over Matter?" *The Guardian – Medical Research (Opinion)*. https://www.theguardian.com/commentisfree/2007/aug/28/mindovermatter.

Bush, G. 1990. "Project of the Decade of the Brain." *Presidential Proclamation 6158*. http://www.loc.gov/loc/brain/proclaim.html.

Calderone, J. 2014. "10 Big Ideas in 10 Years of Brain Science." *Scientific American Mind*. http://www.scientificamerican.com/article/10-big-ideas-in-10-years-of-brain-science/.

Eccles, J. C. 1943. "The Ionic Mechanism of Postsynaptic Inhibition." In *Nobel Lecture*. Stockholm.

–. 1965. *The Brain and the Unity of Conscious Experience*. Cambridge: Cambridge University Press.

–. 1970. *Facing Reality: Philosophical Adventures of a Brain Scientist*. New York: Springer Verlag.

Eccles, J. C., and D. N. Robinson. 1984. *The Wonder of Being Human*. London: Collier Macmillan.

Hyman, S. E. 1998. "NIMH during the Tenure of Director Steven E. Hyman, M.D. (1996-Present): The Now and Future of NIMH." *American Journal of Psychiatry* 155(9 Suppl): 36–40.

Libet, B. 1985. "Unconscious Cerebral Initiative and the Role of Conscious Will in Voluntary Action." *Behavioral and Brain Sciences* 8:529–566. doi:10.1017/S0140525X00044903.

Libet, B., C. A. Gleason, E. W. Wright, and D. K. Pearl. 1983. "Time of Conscious Intention to Act in Relation to Onset of Cerebral Activity (Readiness-Potential)." *Brain* 106:623–642.

Miller, G. A. 2010. "Mistreating Psychology in the Decades of the Brain." *Perspectives on Psychological Science* 5(6):716–743. doi:10.1177/1745691610388774. Mistreating.

Murillo, J. I., and J. M. Giménez-Amaya. 2008. "Tiempo, conciencia y libertad: Consideraciones en torno a los experimentos de B. Libet y colaboradores." *Acta Philosophica* 11(17):291–306.

Schultze-Kraft, M., D. Birman, M. Rusconi, C. Allefeld, K. Görgen, S. Dähne, B. Blankertz, and J. D. Haynes. 2015. "The Point of No Return in Vetoing Self-Initiated Movements." *Proceedings of the National Academy of Sciences* 113(4):1080–85. doi:10.1073/pnas.1513569112.