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Peter Ulric Tse, Neural Basis of Free Will: Criterial Causation,

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Are We Truly Free? A New Neuroscientific Argument in A Debate on Free Will

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Political Dialogues

The problem of free will is one of the oldest, the most significant and the most intriguing issue of philosophy. The discussion started by St. Augustine occupied the greatest minds including Father of the Church himself, Epictetus, Rene Descartes, Xavier Bichat, Blaise Pascal, David Hume, Thomas Hobbes, Arthur Schopenhauer, Friedrich Nietzsche, Martin Heidegger, Henry Stapp, Roger Penrose and many others. A quick analysis of their works, however, creates some kind of a continuum – a story structured by an evolutionary pattern. It emerges very clearly from the views of the listed philosophers, especially Schopenhauer's, Nietzsche's and Heidegger's. While Schopenhauer was arguing the world to be the will itself – in other words – it is filled in by the will, in his theory Nietzsche went a step further by extracting human purposes and acts as the actual matter of the world from Schopenhauer's model. Nietzsche's *will to power* was then rejected by Heidegger who was afraid of the destructive power of such ideology. Instead, he proposed his own counter-argument to the metaphysics of will: *Gelassenheit*, with likely translations of „being allowed to be" and „quiet expectation", and which is Heidegger's solution to acquire the truth about being.

None of the mentioned scientists was the so-called philosopher of will (excluding Schopenhauer), although all of them discovered new aspects of the main problem, listed in following categories: physics; quantum mechanics; teology; philosophy. Not untill the late 1970's those were the only theories about the freedom of will, to hold very different views on its existence. The most popular one argued that there is no free will, which was then scientifically confirmed, in 1980, by Benjamin Libet who conducted an experiment, that gave birth to the new branch of cognitive science: the neuroscience of free will, becoming the most trusted source of theories upon the existence of the freedom of will. Although the result of the experiment was negative, Libet expressed, in the very specific way, a hope that one day some scientists would prove him wrong. In his most famous article Libet wrote: „My conclusion about free will, one genuinely free in the nondetermined sense, is then that its existence is at least as good, if not a better, scientific option than is its denial by determinist theory. Given the speculative nature of both determinist and nondeterminist theories, why not adopt the view that we do have free will ? Such a view would at least allow us to proceed in a way that accepts and accommodates our own deep feeling that we do have free

will. We would not need to view ourselves as machines that act in a manner completely controlled by the known physical laws."[1] 30 years later the day has come. The chain of the evolution of the described story has gained a new link – a Peter Ulric Tse's book „Neural Basis of Free Will: Criterial Causation".

Peter Ulric Tse is an associate professor at Dartmouth College. His early interests concerned the neurophysiology of visual perception, which, in recent years, caused his new scientific interest in the neural bases of human creativity, attention, free will and consciousness. Tse is a leader of the small research team at Dartsmouth's brain imaging lab. This small group conducts research in the branches of cognitive science, which involve Tse's main examination priorities. Under the guidance of the author more than 60 articles were published in reputable scientific journals. The most significant ones are "Attention alters perceived features by defining the domain of preconscious operations (2011)", "Pattern classification precedes regional-average hemodynamic response in early visual cortex (2011)", "Voluntary attention modulates motion -induced mislocalization (2011)". *Neural Basis of Free Will* was released by MIT Press and is the debut of Tse as a single author. His main aims were to summarize the newest neuroscientific research data from all around the world, to present current views in the matter of free will and to propose his own innovative solution for mind-body problem and mental causation, which are the neural foundations of the freedom of will.

The reviewed book consists of six parts: ten chapters of main content, three appendixes, explanatory notes, the glossary of basic concepts, a bibliography and an index of names and concepts. Each paragraph in the book bears the numbering, which in combination with modern and minimalist design of the book makes it very easy to maneuver. The first three chapters serve as a very expanded and detailed preface. Tse introduces a reader to the issues contained in the later section of the book. He explains what is the will, from both philosophical and neurophysiological point of view, and the concept of title criterial causality. The author backs himself up with three appendixes, which provide an additional background for his theory and an overview of the other author's arguments on the freedom of will. Noteworthy is a fact, that at the very beginning of the book Tse highlights a Wittgensteinian distinction between the language of philosophy and the language of empirical science and carries the weights of his arguments toward the latter. Without making even the slightest derogation from the outlined border, he makes a basic summary of his main thesis, which is the model of criterial causation.

The author clearly cuts himself away from epiphenomenal, deterministic and incompatibilistic theories postulated, for instance, by Jaegwon Kim or Daniel Dennett. Referring to the recent discoveries in the field of quantum physics regarding system operations at the level of microparticles, Tse presents a framework for a philosophical position called ontological indeterminism. By the

1 B. Libet, *Do We Have Free Will*, [in:] R. Kane, *The Oxford Handbook of Free Will*, Oxford University Press, New York 2002, p. 563.

long time this paradigm was considered far too absurd, because it was based on the self-causality, which is logically impossible.[2] A premise, which allowed the author to put his theory into the ontological indeterminism paradigm, is based on the comparison between the functioning of computer and the brain. The former is algorithmic, which means it is based on 'the single input – single output relationship'. In other words, it is deterministic in the sense that once the decision was taken, it cannot be changed or canceled during its execution. The argues that the action of the brain at the micro level is not algorithmic, because it uses 'the many inputs – single output relationship'. Therefore, the behavior arising from genetic factors[3] or the results of the prevalence of randomness, and volitional or non-volitional acts are allowed to happen in non-deterministic way. Hence, the author notes that the model of the brain proposed by the ontological determinism offers the possibility of the existence of freedom of will in the strong sense. It must, however, be drawed from the mental causality directed in the conscious and volitional way. Chapters 4, 5 and 6 explain how is that possible.

Although Tse in the introduction to his book suggests the omission of mentioned chapters, none of the readers should have done that. The reason is that their acquaintance is absolutely indispensable and crucial for proper understanding the whole book; in those three chapters the author builds the foundation for his main theory. In this section of the book, Tse provides a synthetic overview of the latest research data in the field of neurophysiology and makes the application of these studies to his idea. The author proposes a three-stage neuronal model of mental causation (presented at Fig. 1.) according to which "(1) new physical/informational criteria are set in a neuronal circuit on the basis of preceding physical/mental processing at time t_1, in part via a mechanism of rapid synaptic resetting that effectively changes the inputs to a postsynaptic neuron. These changes can be driven either volitionally or non-volitionally, depending on the neural circuitry involved. (2) At time t_2, inherently variable inputs arrive at the postsynaptic neuron, and (3) at time t_3 physical/informational criteria are met or not met, leading to postsynaptic neuronal firing or not." (p. 14). Therefore, the fundamental foundation standing at the basis of Tse's theory is agreeing on the assumption that "patterns in input can be genuinely causal only if there are physical detectors, such as neurons, that respond to patterns in input and then change the physical system in which they reside if the criteria for the presence of a pattern in inputs have been met." (p. 9). In other words, the key notion of the book is the definition of epiconnectivity[4]. It allows the acceptance of the non-traditional nature of the signal transfer between neurons. Moreover, according to the author, the

2 The impossibility of self-causation is based on the assumption that mental events (including acts of willing) are realized in physical events, so they cannot alter the physical events in which they are now realized.

3 For example, certain tastes or smells we will always be considered disgusting. Volitional acts have no influence on it.

4 Tse explains the notion of epiconnectivity as follows: „Epigenetic mechanism such as methylation or histone deacetylation can change gene expression without changing the underlying sequence of DNA. Analogously, dynamic synaptic reweighting can change functional neuronal circuitry without changing underlying long-term neuronal connectivity." (p. 266.)

action potential transferred by one cell to another does not contain the full enclosure of transmitted information, only a part of it. This shows an author's example: "Information is as little localized to a single neuron in isolation as gothic or baroque architectural style is isolated to a single brick in a building." (p. 74). He argues, that the information is contained almost only in the neural code transferred within given circuits. Thus, flow of the code is possible oanly through the fulfillment of criteria set on the inputs of postsynaptic neuron by presynaptic ones, namely through the epi-connectivity between neurons. Revolutionary nature of Tse's theory is therefore threefold: 1) this kind of communication between neurons (or mental causation) is immaterial. It is true that action potentials require chemical substrates and energy, but what truly matters here is the observable, but non-physical pattern of the activity in neural circuits.[5] 2) A model of criterial causation is a model of downward causality, because the criteria are established in a volitional way. In other words, there is the descent from the higher cognitive processes to the "lower" physical processes. 3) Tse departs from the functionalist model of how brain works. Instead, he argues that not the particular regions of the brain are responsible for human's behavior, but neural codes appearing on several regions at the very little space of time. The circuits must be, however, the systems with enhanced intermolecular structure. This demand results from physiological determinants of NMDA receptors functioning.[6]

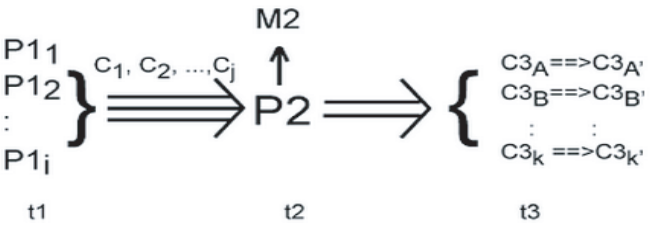

Figure 1. A three-stage neuronal model of mental causation (p. 26).

The conclusion of arguments presented in chapters 4, 5 and 6 is presented in chapter 7, the most important part of the book. Tse summarizes the cited neurobiological data and proposes a philosophical argument for the existence of free will in the strong sense. If his three-stage neural model of mental causation is true, true is also his conclusion that men are capable of making truly free choices. One problem that can arise here is a metaphor, whose Tse has used in chapter 4. The author compared the properly functioning human brain to a idling car: "There must be some baseline level of excitation for information processing to be rapid and dynamic in a neural network because if the baseline were zero

5 Tse compares this phenomenon to the observation of star constellation: "A pattern may not even objectively exist in the world, much as a constellation that we see in the sky does not really exist in the universe, although, of course, the individual stars do. The pattern of the constellation Orion, for example, exists only contingently because of the placement of the Earth, and has no objective existence as a real physical object (…). Because a pattern of particles, or a pattern of neuronal inputs, lacks mass as such, a pattern of energetic inputs can only have causal efficacy above and beyond the traditional causal modes of energy transfer and transformation if there is a criterial detector that responds to that pattern." (p. 166-117).

6 NMDA receptors operate effectively only in very small distances from each other. Even the slightest increase in the distance between them can cause a significant increase of incident response time. "Distances greater than 300 nm lead to essentially no postsynaptic response." (p. 76)

excitation, the circuit would essentially be offline. (...) By analogy, a car must at least be idling if the engine is to be able to respond rapidly to the excitation of the gas pedal." (p. 50-51). If the human brain works in a similar way, then the internally occurring readiness potentials[7] can induce random action potentials causing random human behavior. Hence the author in chapters 8, 9 and 10 focuses on participation and the importance of attention processes and consciousness in volitional decisions. If a person would not have been equipped with these earlier, then it would be impossible to volitionally focus an attention or to track a specific content, causing the impossibility of decoding the propositional criteria. In other words, a man deprived of attention processes and consciousness would bring to mind a non-reflexive zombie (p. 185).

The main goal of Peter Ulric Tse was to resolve one of the oldest philosophical problems, namely the mental causation. Unexpectedly, he manages to achieve this extremely ambitious goal. Theory proposed in the book is very well thought, innovative, supported by huge amount of empirical data (a bibliography assembling all cited publications counts 100 pages), and, the most importantly, consistent with existing research in cognitive science throughout. Tse uses not only the data on the information transferring between neurons, but also he takes into account the study of the physiology of vision, learning, memory, attention processes – especially focusing and sustaining attention – and epiphenomenons associated with them, such as the formation of gamma waves during the process of attention binding. The unusual structure of the book is therefore justified: chapters are logically consistent with each other and their presence is well founded, which significantly facilitates reading.

Neural Basis of Free Will is an extremely challenging book and requires the reader to have a wide and well-established knowledge in the field of cognitive science. It is worth to devote her time, because every second spent on reading it results in the cognition of wealth substantive knowledge, which was put by author for the philosophy of mind and the neurophysiology of will. He also foresaw possible difficulties in understanding the book, so in order to facilitate the reception of his work, he has prepared the appendixes and glossary of basic concepts. Moreover, the book contains very much well-described figures and pictorial metaphors in a way to help the reader to assimilate presented content. This makes *Neural Basis of Free Will* can successfully serve as advanced academic handbook.

The most important advantage of the book is its substantive content. Tse's theory is the first significant one in the philosophy of mind having the chance to revolutionize the dispute about existence of free will and to amount ontological indeterminism to be the leading paradigm in the neurophysiology of will. The author devalues and discards the previous arguments and simultaneously suggests his solution of eternal mystery. Tse moves wide range of problems, whose delicate weight and significance make the

7 B. Libet, *Do We Have Free Will*, [in:] R. Kane, *The Oxford Handbook of Free Will*, Oxford University Press, New York 2002, p. 551-552.

book extremely important in the scientific field and also offering a practical value for both legal and political systems. The author proves the truth of deep belief in human freedom, which is the basis of all social contacts. The book holds together the results of neurobiological research conducted within the past 15 years, becoming in this way “the must read” for all cognitive scientists and a milestone in the oldest philosophical dispute about the freedom of will.