

1. Titolo del progetto di ricerca e keywords: A Neurodynamical Approach to Consciousness

2. Indicazione dell'area di ricerca (SSD Settore scientifico disciplinare): Area 11 - History, philosophy, pedagogy and psychology: M-FIL/02

3. Presentazione generale del progetto e stato dell'arte

The fundamental purpose of this project is to explore the assumptions that (a) consciousness is completely explainable by way of the methodology of contemporary sciences, in particular, cognitive science and neurobiology; (b) the theoretical gap between the concepts of *access-consciousness* and *phenomenal-consciousness* is bridgeable by means of a neurodynamical approach, which is able to correlate the action of transient, metastable coalitions of neuron with first-person experiences (*qualia*) of a certain subject.

A neurodynamical explanation of consciousness in all its facets is highly relevant to philosophical and scientific research on the study of mind, since it allows us to leave behind certain theories that, in the current state of the art, appear obsolete and, by now, lacking in explanatory value, especially if compared to the present state of investigation of other cognitive domains, such as perception and memory. To accomplish this, I propose to shed light on the dynamic processes that correlate subjects' first-person experiences with the cognitive and neurobiological sub-processes that underlie them. I advance this hypothesis as an explanation of *qualia* adherent to the scientific enterprise, but the ultimate goal is not only to take a step forward in a context of studies – the one about consciousness – which seems to be not, at present, on a par with others relative to mind, but also to provide a clearer view of all the elements of human cognition – and brain – that are connected to the mechanisms of consciousness.

4. Obiettivi della ricerca

Given that the explanation of first-person experience is offered by the interpretation of the data obtained from the subjects, to which a dynamical correlation is then sought in the neural activities, the project I advance aims at providing the ideal approach in order to bridge the gap between the experiential domain and the cognitive and neurobiological realms. Consequently, striking and illuminating outcomes can be accomplished: it seems to be possible to develop a research project which can explain consciousness *tout court* in terms of *access-consciousness*, that is to say, in a fruitful way for scientific and philosophical purposes.

5. Metodologia e risultati attesi

The methodology I propose requires the analyzed subject to provide first-person descriptions that can be used as 'public', intersubjective measures of experience, with at least two objectives. The first is to reliably capture the degree of similarity (or dissimilarity) between different subjective phenomena and to produce time measurements that can be compared with those of neural measurements. The second objective is to produce descriptions of the structural invariants of the experience in question, with the aim of constraining the methods that are chosen to determine which neural activities are to be considered significant.

Moreover, the mobilization of any information in consciousness can be characterized by the simultaneous and coherent activation of multiple distant areas to form a single brain-scale workspace. Neuron-rich regions in the workspace should be visualized as active with *brain imaging* methods each time subjects perform an action that is only feasible in a conscious state, as, for example, when a new combination of mental operations is required. Experiments have been conducted with the aim of dissociating what is presented to a subject from what the subject sees, thus distinguishing the neural configurations that are peculiar to conscious perception. Among

the various experimental contexts, these are considered to be of extreme importance: *visual masking, inattention blindness, binocular rivalry*.

In addition to brain imaging, other techniques - capable to record, inhibit and/or stimulate brain processing - must be considered: transcranial magnetic stimulation (TMS), electroencephalography (EEG), optogenetics. The integration of knowledge across the various levels targeted by each method allows for a more detailed understanding of subcellular, neural and large-scale/regional/systems processing peculiar to consciousness.

Furthermore, I argue that it is necessary to capture the dynamics of experience itself. The scientist must make measurements of each phenomenon, both the dynamics of the brain and those of consciousness. In order to be subjected to measurements, the first-person experiences (*qualia*) of individuals must be organized in a statistical universe, indicating the whole range of possible values, states or objects that can be considered valid measurements. A measurement thus consists of the selection of a particular value from a given universe, based on the present state of the observed phenomenon. In the case of subjective experience, this corresponds to the selection of a description from among all the possible written descriptions that can be produced in, say, a two-minute period. Organizing experience in this context means providing a kind of topology, i.e., estimating a distance between two measurements. It should then be possible to say whether measure A is closer to measure B or measure C. Without some kind of topology, it would be complicated to compare the dynamics of two phenomena. In order for measurements to be useful, the subject and the experimenter must agree on a measure of distance, so that anyone can assess the degree of similarity between two measurements. The basic requirement, therefore, is that the distance should be consistent with the subject's experience: if measure A is closer to measure B than to measure C, then the elements of experience that led the subject to select measure A should appear to him to be closer to the elements that led him to select measure B than to the elements associated with measure C. Consequently, recurrences in the subject's experience should be translated into recurrences in the measures. Once measures of certain elements of subjective experience and

measures of neural activity have been provided, it should be possible to establish a relationship between the two phenomena by comparing the dynamics of those measures: related phenomena should provide groups of measures with compatible dynamics.

Essentially, a philosophical approach based on a neurodynamical framework must be consistent with the outcomes of these procedures, together with an inherent logical coherence.

6. Indicazioni bibliografiche:

- Baars, B. J. (1988). *A Cognitive Theory of Consciousness*, Cambridge University Press, Cambridge;
- Bermúdez, J. L. (2020). *Cognitive Science. An Introduction to the Science of the Mind*, Cambridge University Press, Cambridge;
- Block, N (1997). *On a Confusion about a Function of Consciousness*, in N. Block, O. Flanagan, G. Güzeldere (Edited by), *The Nature of Consciousness. Philosophical Debates*, The MIT Press, Cambridge, Massachusetts;
- Chalmers, D. J. (1995). *Facing Up to the Problem of Consciousness*, in «Journal of Consciousness Studies», 2, No. 3;
- Chalmers, D. J. (1996). *The Conscious Mind*, Oxford University Press, Oxford; tr. it. di A. Paternoster, C. Meini, *La Mente Cosciente*, McGraw Hill, Milano, 1999;
- Clark, A. (2001). *Mindware. An Introduction to the Philosophy of Cognitive Science*, Oxford University Press, New York;
- Cosmelli, D., Lachaux, J. P. & Thompson, E. (2007). *Neurodynamical Approaches to Consciousness*, in P. D. Zelazo, M. Moscovitch, E. Thompson (Edited by), *The Cambridge Handbook of Consciousness*, Cambridge University Press, New York, pp. 731-772;
- Crick, F. & Koch, C. (2003). *A Framework for Consciousness*, in «Nature Neuroscience», vol. 6 n. 2, Feb. 2003, pp. 119-126;
- Dehaene, S., Naccache, L. (2001). *Towards a Cognitive Neuroscience of Consciousness: Basic Evidence and a Workspace Framework*, in «Cognition», 79, pp. 1-37;

- Dehaene, S., Kerszberg, M., Changeux, J. P. (1998). *A Neuronal Model of a Global Workspace in Effortful Cognitive Tasks*, in «Proceedings of the national Academy of Sciences USA», Nov. 1998, 95, pp. 14529-14534;
- Dennett, D. C. (1991). *Consciousness Explained*, Little, Brown and Company, New York-Boston-London, 1991; tr. it. di L. Colasanti, *Coscienza. Che cosa è*, Editori Laterza, Bari, 2009;
- Dennett, D. C. (2003). *Who's On First? Heterophenomenology Explained*, in «Journal of Consciousness Studies», 10, No. 9-10, pp. 19-30;
- Dennett, D. C. (2007). *Heterophenomenology Reconsidered*, in «Phenomenology and Cognitive Sciences», 6(1-2), pp. 247-270;
- Dennett, D. C. (2018). *Facing Up To The Hard Question Of Consciousness*, in «Phil. Trans. R. Soc.» B 373: 20170342;
- Di Francesco, M., Marraffa, M., Tomasetta, A. (2017). *Filosofia della Mente. Corpo, coscienza, pensiero*, Carocci Editore, Roma;
- Fell, J. (2004). *Identifying neural correlates of consciousness: The state space approach*, in «Consciousness and Cognition», Apr., 2004, 13, 709-729.
- Fodor, J. A. (1983). *The Modularity of Mind*, The MIT Press, Cambridge;
- Jackson, F. (1982). *Epiphenomenal Qualia*, in «The Philosophical Quarterly», Apr., 1982, Vol. 32, No 127;
- Jackson, F. (1986). *What Mary Didn't Know*, in «The Journal of Philosophy», May, 1986, Vol. 83, No 5;
- Koch, C. (2004). *The Quest for Consciousness: A Neurobiological Approach*, Robert & Company Publishers, Englewood; tr. it. di S. Ferraresi, *Alla Ricerca della Coscienza: una Prospettiva Neurobiologica*, UTET, Torino, 2007;
- Kriegel, U. (2007). *Philosophical Theories of Consciousness: Contemporary Western Perspectives*, in P. D. Zelazo, M. Moscovitch, E. Thompson (Edited by), *The Cambridge Handbook of Consciousness*, Cambridge University Press, New York;
- McDermott, D. (2007). *Artificial Intelligence and Consciousness*, in P. D. Zelazo, M. Moscovitch, E. Thompson (Edited by), *The Cambridge Handbook of Consciousness*, Cambridge University Press, New York;

- McGovern, K. & Baars, B. J. (2007). *Cognitive Theories of Consciousness*, in P. D. Zelazo, M. Moscovitch, E. Thompson (Edited by), *The Cambridge Handbook of Consciousness*, Cambridge University Press, New York, pp. 177-205;
- Nagel, T. (1974). *What Is It like to Be a Bat?*, in «The Philosophical Review», Oct., 1974, Vol. 83, No. 4;
- Oizumi, M. & Albantakis, L. & Tononi, G. (2014). *From the Phenomenology to the Mechanisms of Consciousness: Integrated Information Theory 3.0*, PLoS Comput Biol 10(5): e1003588;
- Putnam, H. (1975). *Philosophical Papers, vol. II: Mind, Language, and Reality*, Cambridge University Press, Cambridge;
- Seager, W. (2007). *A Brief History of the Philosophical Problem of Consciousness*, in P. D. Zelazo, M. Moscovitch, E. Thompson (Edited by), *The Cambridge Handbook of Consciousness*, Cambridge University Press, New York;
- Searle, J. R. (1980). *Minds, brains, programs*, in «The Behavioral and Brain Sciences», 3;
- Tononi, G. & Edelman, G. M. (1998). *Consciousness and Complexity*, in «Science» 282, 1846;
- Tononi, G. & Boly, M. & Massimini, M & Koch, C. (2016). *Integrated Information Theory: from Consciousness to its Physical Substrate*, in «Nature Reviews», July 2016, Vol. 17, 450-461.

7. Descrizione delle ricerca nel triennio (fattibilità)

- Deep analysis of the reductionist and anti-reductionist theories about consciousness;
- Emphasis on the problems which characterize anti-reductionist approaches;
- Proposal of a logically coherent neurodynamical theory of consciousness which is able to bridge the gap between access-consciousness and phenomenal-consciousness.

I believe that three years of intense research are sufficient to develop solid foundations for a neurodynamical

approach to consciousness capable to satisfy the goals
previously set.