How the Discovery of Brain Correlates of Consciousness Supports Non-Reductive Physicalism

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Abstract

In this work I attempt to justify the claim that the discovery of statistically relevant brain correlates of consciousness supports Non-Reductive Physicalism. First I distinguish the main varieties of Reductive and Non-Reductive Physicalism, selecting the right one that is benefited by progress in brain sciences. Second, I discuss epistemological problems in the search of brain correlates of consciousness, focusing on the simultaneous occurrence of conscious activity, known by means of subjective report, and the corresponding brain activity, registered with the help of technology. Finally, I argue – using Salmon´s concept of Statistical Explanation - that statistics affords a distinction of causal (physical) from casual (illusory) correlations.

Varieties of Reductive Physicalism

- In Reductive Physicalism, the reduced theory is Psychology (both folk and scientific). The difference between the reductive varieties lies in the proposed *explanans*:
- A) for Micro-Reductionists, psychological properties are going to be explained in terms of micro/molecular entities and their relations, e.g. by means of the interaction of biological molecules with receptor proteins;
- B) for Math-Reductionists, psychological properties are going to be explained by models of Mathematical Physics, e.g. Dynamical Systems Theory;
- C) for Fundamentalists, psychological properties are going to be explained by fundamental physical theories, as quantum and string theories, e.g. conscious states considered as quantum coherent conformations of neuronal microtubules.

Ontological NRP

- The term ‘Physicalism’ can be interpreted relatively to one area of science – Physics – or to the whole of science.
- In the first case, NRP is an (ontological) hypothesis that everything that is real and can be known is physical, but such a physical reality has levels that cannot be reduced to other levels.
- In this view, “physical” means all that has matter, energy, information or any combination of them (IOW, all that is in accord to what contemporary Physics considers as necessary to produce a physical phenomenon, i.e., a phenomenon that can be studied by the methods of Physics).
- This ontological formulation of NRP is metaphysical; the levels of reality are not conceived as dependent on methods of construction of knowledge.

Interdisciplinary NRP

- A second class of NRP is one that takes into account the method by which we come to know the physical world. The resulting ‘Interdisciplinary Physicalism’ includes other sciences besides Physics. It has two variants:

A) Epistemological NRIP (or Pluralism) postulates an irreducible plurality of methods for the study psychological phenomena. The resulting different views of physical reality are conceived as determined by the methods;

B) Pragmatic NRIP postulates that the choice of methods is ultimately pragmatic, and therefore different views can be made compatible when convenient. In scientific practice (i.e., ‘a posteriori’), the existence of statistically meaningful correlations between phenomena indicates that they belong to the same physical reality.

Contrastive Methods in Consciousness Research

- One strategy to identify brain patterns that support conscious processing is to contrast brain activity in the presence and absence of a reported conscious content (the “contrastive method” described by Baars, 1997).
- A similar strategy is often used in fMRI studies in Cognitive Neuroscience. The “subtraction” operation consists of literally subtracting measured values of unconscious activity from registers of conscious activities. The result of the subtraction operation is regarded as the neural correlate of the reported conscious content.

The Problem of Underdetermination

- a) Given a stimulus, in masked and non-masked conditions, the non-masked condition causes conscious perception C at time t;
- b) Scientists subtract one from the other to find the brain pattern P of activity that corresponds to C;
- c) The experimenter knows that C occurs to the experimental subject only by means of a report that occurs at time t';
- d) At time t', it is a (short-term) memory trace of C (supposedly related to P) that is reported;
- e) Even if the report is collected as close as possible to the occurrence of C, its relation with P remains underdetermined, since reporting requires complex brain operations;
- f) There is no way to determine (in the millisecond scale) when C occurred and therefore it is not possible deduce that P causes C.

Probabilistic Causation

- A set of causes may be neither necessary nor sufficient, but "support" or contribute for the effects. This situation, that is frequent in the context of biological and human sciences, can be described in terms of the presence of the causes increasing the probability of the effects. A classical example is the statement "smoking causes cancer". Smoking is not sufficient for cancer, since many smokers fortunately do not develop that disease. It is not necessary, since many cancer patients did not smoke. It is not an accidental correlation either, since the connection between smoking an having cancer has been shown to be statistically meaningful. Smoking is a factor that has an influence on the putative mechanisms of cancer generation, contributing but not determining its occurrence.

Probabilistic Explanation

- Given the underdetermination of hypotheses by available data, the deduction of conscious phenomena from brain activity is not feasible, but a probabilistic explanation is possible;
- In scientific experimental settings, statistical tests are used to assure the significance of the connection of causes and effects, allowing the distinction of casual (or accidental), and causal relations.
- Statistically meaningful correlations can afford a causal - although not a deductive/reductive - explanation of mental phenomena from its physical correlates.

Dual-Aspect Monism

- The occurrence of brain widespread high-frequency synchrony following the presentation of a visual stimulus is a factor that significantly increases the probability of the stimulus being consciously perceived.
- In the so-called "Mind-Reading" paradigm (Kamitami and Tong, 2005, Haynes and Rees, 2006), fMRI is used to predict (with high probability) conscious content based on differential activation of brain areas.
- The high degree of correlation between kinds of brain activity and conscious processes suggest that, although displaying different modes of appearance to the scientific observer, they are ultimately aspects of the same underlying reality (Dual-Aspect Monism, which is in this regard equivalent to NRIP).

Concluding Remarks

- The impossibility of deducing the effects (conscious processes) from the causes (brain activity) counts against a Reductionist interpretation of neuroscientific results. The question that remains is if the difference between both is the result of an absolute methodological divide, an interpretation that would lead to property dualism or pluralism. However, these positions do not account for strong correlations of physical and mental events.
- Therefore, the conclusion to be drawn is that physical and mental properties, although appearing as different to the human observer, do not belong to different domains of reality. This conclusion is better fit by Pragmatic NRP, because this position is not attached to metaphysical preconceptions about the structure of reality, being open to new ontological implications derived from scientific discoveries and theoretical models.