Theory of Neuroscience

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Editorial

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Theory of Neuroscience

Neuroscience is the study of nervous system concerning biological basis of **consciousness**, **perception**, memory, and learning. Neuroscience links our observations about **cognitive behavior** with the actual physical processes that support such behavior. Nervous system as a lineage structure with features of self-organizing and changes with use throughout the lifetime. Science when considering like a paradigm and solving problematic data by using theories in the light of philosophy. Successful pattern of theories enlightened improvement in chemistry and physics. In biology somehow disscussions in complicated systems are still lack of motive force of rules. Neurobiology itself is a dynamic wondering world. Researchers need some basic theories of neuroscience when dealing with sophisticated nervous system problems. A number of researchers in computational/systems neuroscience and in information/communication theory are investigating problems of information representation and processing. While the goals are often the same, these researchers bring different perspectives and points of view to a common set of neuroscience problems. Often they participate in different fora and their interaction is limited. Beyond these original methods there is a need to develop novel tools and approaches that are driven by problems arising in neuroscience.

I would like to begin to discuss these four basic concepts of neuroscience as consciousness, perception, cognition and behaviour respectively.

Consciousness

Clinical observations have established that certain parts of the brain are essential for consciousness whereas other parts are not. For example, different areas of the cerebral cortex contribute different modalities and submodalities of consciousness, whereas the cerebellum does not, despite having even more neurons. It is also well established that consciousness depends on the way the brain functions. For example, consciousness is much reduced during slow wave sleep and generalized seizures, even though the levels of neural activity are comparable or higher than in wakefulness. To understand why this is so, empirical observations on the neural correlates of consciousness need to be complemented by a principled theoretical approach. Otherwise, it is unlikely that we could ever establish to what extend consciousness is present in neurological conditions such as akinetic mutism, psychomotor seizures, or sleepwalking, and to what extent it is present in newborn babies and animals [(15)].

Each person has privileged access to his own consciousness, but not to the consciousness of others. So consciousness is not a publicly observable, phenomenon and, in this respect, unlike the phenomena typically studied by the science. This conception of privacy is confused [(2)]. The mysteriousness of consciousness as something we become, but not something we do or can be trained to become. One can be good at learning, discovering, detecting or finding out certain things, but one cannot be good at becoming conscious of things [(2)].

Becoming conscious, becoming aware, etc., are not things we do, let alone actions we perform. Mental processes are just brain processes and that consciousness is a natural phenomenon. It is possible to construct a theory about its nature by blending insights from neuroscience, philosophy of the mind, phenomenology, psychology and evolutionary biology [(12)].

Perception and representation

Perception, imitation, and as a result behaviour modulate in a consciousness state reserving memory and learning as basic elements in the neuroscience status. Entropy in this system indicates disordered condition. In their chapter on sensation and perception Bennett & Hacker describe theories of perception that depend on the concept of representation [(2)]. Modern representationalist theories hold that representations are the brain's symbolic descriptions or interpretations (as opposed to isomorphic copies) of the world, from which the brain draws inferences about what is really there. As neuroscience methods improve (in particular, in vivo real-time imaging and electrophysiology) we appear closer and closer to having the neural referent of the representation. One of the most important goals of neuroscience is to establish precise structure-function relationships in the brain. Since the 19th century, a major scientific endeavour has been to associate structurally distinct cortical regions with specific cognitive functions. Modern neuroimaging techniques with high spatial resolution have promised an alternative approach, enabling non-invasive measurements of regionally specific changes of brain activity that are correlated with certain components of a cognitive process. Reviewing classic approaches toward brain structure-function relationships that are based on correlational approaches are not sufficient to provide an understanding of the operation principles of a dynamic system such as the brain but must be complemented by models based on general system theory [(14)].

Cognition and cogitation

In between consciousness and behaviour, cognition states as a psychological power in the neuroscience issues. Cognitive neuroscience research on working memory has been largely motivated by a standard model that arose from the melding of psychological theory with neuroscience data [(10)]. Sherrington's pioneering classic neuroscientific findings, split brain phenomena, Penfield's observations in the operating room generated much dualistic theories [(9,11,13)]. Research from lesion and functional neuroimaging studies on remote episodic, semantic and spatial memory in humans is crucial for evaluating three theories of hippocampal and/or medial temporal lobe-neocortical interaction in memory retention and retrieval: cognitive map theory, standard consolidation theory and multiple trace theory. Each of these theories has strengths and weaknesses, and there are various unresolved issues. New theories had proposed such as a unified account based on multiple trace theory [(8)]. There is a mismatch in timing between the development of concepts and the experimental techniqes in the neurosciences and it should be asked to what extend this disparity is of relevance to modern discussions of mind, brain and cognition [(4)].

Some authors consider cogitation as the human powers of belief, thought, and imagination [(2)]. Studies in neurogenetic and behavioural neuroscience may indicate the relationship of such a complicated phenomenon.

Behaviour

All mentioned previous neuroscience challenges operate to support behaviour. Studies of multidimensional systems have founded radical hypothesis on the role of neuronal attractors in information processing, perception and memory and two elaborate models of the internal states of the brain. Their modifications during cognitive functions are given special attention due to their functional and adaptive capabilities [7]. Analysing fMRI data and designing experiments, will relieve the attemps moving from cognition to behavior [6].

The distinction between “philosophy of neuroscience” and “neurophilosophy” has become clearer, due primarily to more questions now being pursued in both areas. Philosophy of neuroscience still tends to pose traditional questions from philosophy of science specifically about neuroscience. Such questions now include: What is a neuroscientific explanation? What are the explananda of neuroscience? How is it that the instruments used by neuroscientists (e.g. neuroimaging, cell recordings, genetic manipulations, simulations) yield knowledge? Answers to these questions can be pursued either descriptively (how *does* neuroscience proceed?) or normatively (how *should* neuroscience proceed)? Normative projects in philosophy of neuroscience can be deconstructive, by criticizing claims made by neuroscientists. Or they can be constructive, by proposing theories of neuronal phenomena or methods for interpreting neuroscientific data. These latter projects are often indistinguishable from theoretical neuroscience [3]. Neuro-philosophy still applies findings from the neurosciences to traditional, mainstream philosophical questions, especially ones concerning psychological states. Examples now include: What are emotions? How is perceptual knowledge possible? How do we predict each other's behavior? Neurophilosophical answers to these questions are constrained by what neuroscience reveals about the realizers of these psychological states. For example, Hirstein (2003) examines implications of neurological syndromes involving confabulation for the concept of self-knowledge [5].

Theoretical neuroscience should use the tools of theoretical sciences like cybernetics, informatics, computational neurosciences or system science. For instance little is known about mechanisms that initiate and maintain the growth of the sinoatrial (SA) node. What is the source of SA node’s electricity? The methodology of systems science permits the modelling of complex dynamic non-linear systems. Such procedures might help us to understand brain functions and the disorders and actions of drugs better [1].

Lots of emerging field of neurobiological research awaits a general unified theory of neuroscience that might then allow its full integration into the accepted framework of biology. Intellectual abstraction (including language, art and science) and emotional acceleration are synthesized into a theoretical whole. The resulting model will roughly resemble the human mind.

To solve these problems and get philosophers and neuroscientists on the same page will require a new view of meaning, what it is, where it comes from, how it evolves, and what exactly it has to do with usage norms. Such a view is, I think, not too far off.

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