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An Overview of Cognitive Neuroscience

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Introduction

The scientific area of cognitive neuroscience is concerned with the study of the biological processes and characteristics that underpin cognition, with a particular focus on the neuronal connections in the brain that are engaged in mental processes. It looks at how neural networks in the brain influence or control cognitive tasks. Cognitive neuroscience is a subfield of both neuroscience and psychology that overlaps with behavioural neuroscience, cognitive psychology, physiological psychology, and affective neuroscience, among other fields. Cognitive neuroscience is based on cognitive science hypotheses combined with neurobiological evidence and computational modelling. In this discipline, several parts of the brain play a significant role. Because the fundamental objective is to build a neuronal understanding of cognition, together with the diverse lobes of the cerebral cortex, neurons play the most important function. Experimental approaches from psychophysics and cognitive psychology, functional neuroimaging, electrophysiology, cognitive genomics, and behavioural genetics are all used in cognitive neuroscience [1].

Description

Patients with cognitive abnormalities owing to brain injuries are a crucial part of cognitive neuroscience research. In terms of healthy and fully functioning brains, the damages in lessoned brains provide a comparable starting point. These injuries disrupt the brain's neuronal networks, causing it to malfunction during basic cognitive functions including memory and learning. We may assess how healthy brain networks function in the presence of such damage and derive inferences about the basis of the impacted cognitive processes. In addition, the subfield of developmental cognitive neuroscience studies and investigates cognitive capacities based on brain development. This chart depicts brain growth across time, evaluating differences and speculating on possible causes. Cognitive neuroscience is a trans disciplinary field of research that combines neuroscience and psychology. There were numerous stages in these disciplines that transformed the way academics approached their research, leading to the field's full establishment [2].

Although the goal of cognitive neuroscience is to understand the neural mechanisms that govern the mind, it has historically focused on how a certain area of the brain supports a particular mental faculty. Early attempts to subdivide the brain, however, were unsuccessful. The phrenologist movement was dismissed after failing to provide a scientific basis for its claims. Brain mapping, which began with Hitzig and Fritsch's experiments and eventually developed through methods such as Positron Emission Tomography (PET) and functional magnetic resonance imaging, also rejected the aggregate field view, which stated that all areas of the brain were involved in all behaviour (fMRI). The cognitive revolution, Gestalt theory, and neuropsychology were important turning points in the development of cognitive neuroscience as a field, bringing together concepts and methodologies that allowed researchers to discover more connections between behaviour and its brain underpinnings [3].

"The idea that describing a phenomenon entails understanding the mechanism responsible for it has deep roots in the History of Philosophy, from atomic theories in the 5th century B.C. through its resuscitation in the 17th and 18th centuries in the writings of Galileo, Descartes, and Boyle," says one scholar. OtherAvrs include Descartes' theory that machines built by people can serve as models for scientific explanation. Aristotle, for example, believed that the brain served as the body's cooling system, and that intelligence resided in the heart. "The idea that describing a phenomenon entails understanding the mechanism responsible for it has deep roots in the History of Philosophy, from atomic theories in the 5th century B.C. through its resuscitation in the 17th and 18th centuries in the writings of Galileo, Descartes, and Boyle," says one scholar. OtherAvrs include Descartes' theory that machines built by people can serve as models for scientific explanation. Aristotle, for example, believed that the brain served as the body's cooling system, and that intelligence resided in the heart. The Roman physician Galen, who declared that the brain was the source of mental activity in the second century AD, has been credited with being the first to believe otherwise, while this has also been attributed to Alcmaeon. Galen, on the other hand, believed that other organs, not the brain, were responsible for personality and emotion. Anatomist and physician Andreas Vesalius was the first to believe that the brain and nerve system are at the centre of the mind and emotion. Psychology, a significant contributor to cognitive neuroscience, arose from philosophical considerations about the mind [4,5].

Birth of cognitive science

The Massachusetts Institute of Technology hosted a large-scale meeting of cognitivists. Noam Chomsky and Newell & Simon presented their results on computer science, while George A. Miller delivered his article "The Magical Number Seven, Plus or Minus Two". In his book Cognitive Psychology, published in 1967, Ulric Neisser remarked on several of the discoveries presented at this symposium. In the 1950s and 1960s, the term "psychology" was becoming obsolete, thus the field was renamed "cognitive science." Miller and other behaviourists began to concentrate on the representation of language rather than general behaviour. David Marr came to the conclusion that any cognitive activity should be understood on three levels of examination. Computational, algorithmic/representational, and physical levels of analysis are among them [2].

Conclusion

Prior to the 1980s, there was little contact between neuroscience and cognitive science. Between the 1950s and 1960s, cognitive neuroscience began to connect the freshly created theoretical basis in cognitive science with methodologies from experimental psychology, neuropsychology, and neuroscience. (It wasn't until 1971 that neuroscience became a united discipline.) TMS (1985) and fMRI (functional magnetic resonance imaging) are two novel technologies that emerged in the late twentieth century and are currently the core of cognitive neuroscience research (1991). EEG (human EEG 1920) and MEG were two of the first tools utilised in cognitive neuroscience (1968). Other brain imaging modalities, such as PET and SPECT, are occasionally used by cognitive neuroscientists. NIRS, which employs light absorption to determine variations in oxy- and deoxyhemoglobin in cortical regions, is a new approach in neuroscience. Single-unit recording

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can be employed in some animals. Microneurography, face EMG, and eye tracking are some of the other techniques used. Integrative neuroscience aims to bring data from diverse domains and scales together in databases to construct unified descriptive models: biology, psychology, anatomy, and clinical practise.

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