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Preface

Introduction: The cognitive neuroscience of thought

Human thought has been a puzzling subject among philosophers for the major part of our recorded history, most famously encapsulated in Descartes' *Cogito ergo sum* (I think therefore I am). Although our knowledge of thought and its benefits has come a long way since Descartes, it is only in recent times that empirical investigations into the neuroscientific bases of thought and cognition have been conducted. With the manuscripts compiled in this special issue of *Brain Research*, we discuss recent investigations and include some novel studies, in many distinct research areas under the broad umbrella of the cognitive neuroscience of thought. This issue should serve to summarize our current knowledge and future perspectives on thought and its role in human cognition.

For a few years now the prefrontal cortex in the frontal lobe of the brain has been viewed as the seat of many higher order cognitive processes. Coutlee and Huettel review recent literature in the field of the neural structures and circuits involved in directing thought and decision-making (Coutlee and Huettel, 2012–this issue). They further discuss the neuroanatomy of how intentions and desires may control actions, and propose conceptual models for linking cognitive control and decision-making (Coutlee and Huettel, 2012–this issue).

Reasoning engages thought, and is one of the major cognitive processes responsible for human problem solving abilities. Reasoning is often exercised in comparative manner, for example, by making analogies. Daniel Krawczyk reviews recent relational reasoning studies including neuroimaging investigations, highlighting major advancements in the search for brain structures involved in abstract and analogical reasoning (Krawczyk et al., 2012–this issue). With the help of some novel fMRI results, Stollstorff et al. present an appealing case for the right lateral prefrontal cortex in the brain, being responsible for resolving conflicts during deductive, logical reasoning (Stollstorff et al., 2012–this issue). The role played by language in the human ability to make logical deductions has been the subject of many studies in the past, without the emergence of a uniformly agreed view. Monti and Osherson discuss some of the reasons for the ambiguities observed among neuroimaging experiments conducted on the link between logic and language. Further, they review recent literature suggesting that language plays a role only in the early stages of deductive reasoning (Monti and Osherson, 2012–this issue).

Interestingly, the act of inferring other people's thoughts and feelings appears to share neural substrates with the recollection of memory associated with autobiographical information, which is obtained through personal experiences. Using fMRI, Spreng and Mar investigate the functional overlaps that may facilitate the merging of personal experiences into interpersonal concepts, presenting a novel perspective on the importance of memory in the neuroscience of social cognition (Spreng and Mar, 2012–this issue).

While most cognitive neuroscientists equate human thought with goal-directed deliberation, and effortful mental processes directed towards solving difficult tasks, recent theoretical developments are beginning to view goal-directed thinking as only one of the possible forms of human thought. The cognitive and neural correlates of these different forms of thoughts, and how they related to each of other from theoretical perspective, have been intriguing topics of research in recent times. One additional form of thought that has recently started gaining increasing interest amongst cognitive neuroscientists is spontaneous thought, which often occurs in the forms of mind wandering or day dreaming, and is also sometimes referred to as stimulus-independent thought.

Kalina Christoff reviews recent literature in these exciting, and relatively new, research areas that fall in the realm of undirected thought flow (Christoff, 2012–this issue). She further discusses the neural correlates of undirected thought, and also presents novel evidence suggesting functional connectivities between large-scale brain networks such as the default mode and executive networks during mind wandering tasks (Christoff, 2012–this issue). Taking a further step in the direction of goal-unrelated thought, Smallwood et al. discuss an exciting proposition that amidst various external, environmental influences, internal trains of thought may be generated in the brain through cooperation between the default-mode and frontal-parietal networks (Smallwood et al., 2012–this issue). Their hypothesis presents a novel explanation to why the generation of internal thoughts are often associated with a state of perceptual decoupling.

The brain represents an incredibly complex machine, whose design and working principles are only beginning to be comprehended. A machine-learning approach to understanding a complex system would mean attempting to reconstruct it/its

properties. We round-up this special issue by introducing two novel and distinct approaches to understanding and reconstructing the mechanistic aspects of thought and cognition. In the first, Hesslow discusses the current status of his simulation theory of thought-generation, which postulates that many thought processes can be seen as simulated interactions with the environment (Hesslow, 2012–this issue). He further reviews recent literature on memory research that may serve to test some of the predictions of the theory (Hesslow, 2012–this issue). On the other hand, Fingelkurts et al. take an operational architectonic model approach and discuss the possibilities and problems associated with producing man-made or ‘machine’ consciousness and artificial thoughts (Fingelkurts et al., 2012–this issue).

The future years present exciting times in the field of the cognitive neuroscience of thought. Our unique self-inquisitiveness enables us to make repeated attempts to understand how the brain produces, directs, controls and uses various forms of thought, properties that are central to being human. We would like to thank all the contributing authors, as well as the members of the editorial board of Brain Research for their excellent support during the preparation and compilation of this special issue.

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