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Cognitive–emotional interactions

Emerging perspectives on emotion–cognition interactions

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The French mathematician and philosopher Blaise Pascal once wrote, 'The heart has its reasons which reason knows not of.' This message – that emotion and cognition are separate systems that seldom interact – has a long history in Western philosophy and science. However, the past two decades have seen a remarkable shift in this view as behavioral and neuroscience data have demonstrated that emotion and cognition not only interact, but that their integrative operation is necessary for adaptive functioning. Several topics previously studied only in the context of 'cold' cognitive processes – ranging from decision-making to memory – are now rich areas of research for the interplay of cognitive and affective processes.

The Opinion article by Feldman Barrett *et al*. in this issue of *TICS* [1] is the first of a new series of articles reviewing recent developments in the study of cognition–emotion. In selecting topics for this series, an emphasis was placed upon representing work demonstrating fundamental aspects of emotion–cognition interactions that either have not yet received much attention or whose recent progress has not been reviewed recently. With this in mind, we focused this series along four broad themes or questions.

First, how is that processes generally considered 'cognitive' are altered by 'affect' and vice versa? This fundamental question about emotion–cognition interactions concerns how each process influences the other. Reviews in this series will cover emerging topics on this bidirectional relationship. For example, recent work suggests that contrary to Pascal's notion that thought knows nothing of feeling, language is integral to many aspects of emotional responding, including perception and experience. Current social cognitive work is also providing new insights into the way in which affect, and mood in particular, informs different types of cognitive judgments. And although it has long been recognized that emotion can shape the experience and perception of time, recent work on the neural bases of timing has provided new insights into how this shaping takes place.

Second, how do the neural mechanisms of emotion and cognition interact to allow adaptive learning and choices? A primary driving force behind the resurgence of emotion as an important topic of investigation in the study of human cognition has been animal models detailing the intricate interactions among neural systems mediating these behaviors. This series incorporates reviews examining topics from neuroscience that have only recently been extended to human function. For example, although the human amygdala has been explored primarily for its role in processing threat and/or arousal, there is abundant evidence that – in conjunction with the orbitofrontal cortex – it can also play an important role in reward learning. In addition, technical and ethical limitations have often made it difficult to examine the role of specific neurotransmitter systems in humans. However, combining animal models with behavioral assessments and pharmacological manipulations in humans is starting to yield important insights into the complementary roles of serotonin and dopamine in human emotional learning.

Third, how might our emerging understanding of the interaction of emotion and cognition be extended to topics that are important outside the laboratory? One of the motivating factors in both investigating and funding research on emotion and cognition is the relevance to important behaviors outside the laboratory, such as psychopathology and optimizing human potential. Articles in this series will attempt to make this translational connection. For instance, research on emotion regulation (reviewed in Ref. [2]) has clear links to cognitive-behavioral therapy and the treatment of a range of psychological disorders. However, an open question is how are emotion–cognition interactions altered in psychopathology? Equally important is the question of how the links between emotion and cognition might be tuned through training and mental practice. In this regard, the power of meditation to combat stress and promote healing has been increasingly documented, and emerging work provides insights into the ways that these effects might involve changes in the neural systems underlying cognition–emotion interactions.

And finally, how should we conceptualize the relationship between emotion and cognition moving forward? Although psychological investigations of emotion and social cognition traditionally have proceeded in parallel, human functional imaging work has increasingly suggested that they depend upon overlapping neural systems. Why should that be the case? What do emotion and social cognition have in common? Part of the answer might be that social cognitive processes play an integral role in emotional appraisal, learning and regulation. That being said, and given our current understanding of the extensive

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interactions of emotion and cognition more generally, we might ask whether it even makes sense to attempt to distinguish the separate contributions of each in guiding behavior – or whether it is time to move beyond a dual process approach to more detailed models of their interactions.

In deciding which topics to include, some emerging areas of research and important new perspectives must necessarily be left out. The overarching goal of this series is therefore not to be exhaustive, but to highlight selectively timely issues, findings and approaches to cognition–emotion interactions. In this regard, we are reminded that Pascal also wrote, 'We know the truth, not only by the reason, but also by the heart'. With any luck, the articles in this series will illustrate emerging truths about how reason and the heart – or cognition and emotion – offer not just different means for knowing, but form an interactive partnership for adaptively guiding behavior.

References

1 Feldman Barrett, L. *et al.* (2007) Language as context for the perception of emotion. *Trends Cogn. Sci* 11, 327–332
2 Ochsner, K.N. and Gross, J.J. (2005) The cognitive control of emotion. *Trends Cogn. Sci.* 9, 242–249