State of the union between cognitive neuroscience and emotion


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The 15th Annual Meeting of the Cognitive Neuroscience Society brought together researchers and exhibitors to discuss and present data relevant to the study of the mind using neuroscience methods, especially neuroimaging. A history of interdisciplinary communication, which was the basis of the creation of this society, continues to expand the scope of work presented at the meeting to include research on emotional and social processes as well as various forms of psychopathology. Neurotherapeutics and individual differences in treatment responsivity may be on the horizon.

The 2008 Annual Meeting of the Cognitive Neuroscience Society took place in San Francisco (CA, USA) at the Hyatt Regency Hotel from 12th to 15th April. The term cognitive neuroscience has been recognized for approximately 30 years and is, by definition, an interdisciplinary field exploring connections between cognition and the nervous system. Cognitive neuroscience was made possible by a revolution in cognitive science in the 1950s, which stemmed from empirical evidence of mental events that penetrated the black box of the mind, which was considered impossible to study empirically for decades preceding this movement. Important figures transcending the strict limits of behaviorism in this era included George A Miller, Donald Broadbent, Noam Chomsky and then continuing through the 1980s with Daniel Dennet, Douglas Hofstadter and Howard Gardner, among others. At the height of this exciting inroad into the scientific study of the mind, a call for integrative work, including psychology, linguistics, philosophy, neuroscience and other disciplines, emerged. Michael Gazzaniga and others formed the Cognitive Neuroscience Society in 1994 to highlight the study of cognitive science using neuroscience methods. The society now boasts an international membership of more than 2000. In recent years, the scope of research presented in the society’s journal, The Journal of Cognitive Neuroscience, and research presented at the annual meeting has broadened to include not only basic cognitive research (e.g., attention, perception and memory), but also an increasing sample of work from the scientific study of emotion in the nervous system.

Beginning with the preconference tribute to Michael Gazzaniga, one of the founders of the term cognitive neuroscience and the Society for Cognitive Neuroscience, explorations into emotion research were discussed. Dr Gazzaniga has shown in his own work that both brain hemispheres contribute to understanding emotional facial expressions [1]. The work of his former graduate student, Joseph LeDoux, is especially related to emotion. Dr LeDoux discussed his history with Dr Gazzaniga and how he branched out to study the emotional brain with his research on fear conditioning and the amygdala. Michael Posner, a pioneer in the field of attention, reported on the expansion of his attentional models to include monitoring of emotional conflict made possible by the ventral anterior cingulate cortex.

Three of the meeting’s nine symposia directly featured research on emotion. Of the remaining six symposia, five focused on cognitive processing (e.g., memory, attention and cognitive control) and one on neuroimaging methods. The first symposium at the 2008 meeting focused on the nature and neural representation of
expectancy in emotion processing. Brian Knutson summarized his research showing that emotion influences our propensities to make risky financial decisions. Also in that symposium, Daniela Schiller emphasized the importance of the amygdala and dorsal striatum in our ability to make predictions of aversive future events. Jack Nitschke provided evidence of the overlap in neural areas responsive to anticipating and actually experiencing emotional events and irregularities observed in anxiety disorders. Jon-Kar Zubieta provided evidence showing that activity in the nucleus accumbens in response to reward is correlated with dopamine release to placebo analgesic medication.

In another symposium emphasizing social and emotional processes, Daniela Schiller showed that the amygdala responds to both aversive and appetitive (positive) value learning tasks. Christian Keysner discussed findings supportive of “emotional contagion” whereby seeing others’ emotional displays influences our own affective states. Also in that symposium, Kevin Ochsner discussed individual differences in emotional expressivity in terms of accuracy in judging others’ emotions from facial expressions.

The third symposium centered on emotion research implicating the insular cortex. Bud Craig presented his model of anterior insula function emphasizing both interoception and empathy. Tania Singer drew connections between alexithymia, autism and empathy suggested by her research on the anterior insula. Christian Keysner discussed how different sectors of the insula and neighboring operculum may code emotional feelings and contribute to understanding others’ emotions. Kerstin Preuschoff borrowed an economic principle, financial decision theory, to highlight the importance of the anterior insula in making risky decisions under conditions of uncertainty.

Affective and social neurosciences are also being increasingly represented in poster sessions presented at the Cognitive Neuroscience Society meetings in recent years. In the last few years, a stable number of poster presentations have focused on affect or emotion (102 in 2008) with a handful presenting data on mood disorders (six in 2008) or anxiety (five in 2008). Among the highlights, a popular poster presented by Tor Wager described a new method by which path analysis combined with a mediation analysis can provide evidence for how two brain areas correlate dynamically as a function of a third factor (e.g., another brain area, effectiveness in an emotion regulation strategy and performance on a behavioral task) [2]. Danielle Green et al. presented work showing relationships between peripheral psychophysiology and functional MRI recorded neural activity while phobic patients anticipate and respond to evocative stimuli [3]. Advances in cortical thickness measures were highlighted in another poster session by Catherine Hartley et al. as a function of peripheral psychophysiological responses to emotional stimuli [4]. Alison Staples et al. provided evidence that patients suffering from generalized anxiety disorder might avoid processing aversive emotional stimuli by averting their gaze from particularly evocative regions of emotional pictures as a function of subjective experiences of anxiety during anticipation of the pictures [5]. A poster by Csilla Felsen et al. suggested that a patient with extensive amygdala lesions could still discriminate fearful from neutral facial expressions, but had problems in processing ambiguous fearful faces [6].

Issues related to treatment of psychiatric disorders are less commonly part of the symposia and posters at the Cognitive Neuroscience Society meetings (one symposium and one poster in 2008). One of the challenges for treatment research in psychiatric patients using neuroscience methods is to find a stable measure that reliably differentiates patients from healthy controls (sensitivity) and distinguishes pathological conditions from one another (specificity). Important directions for the field include the examination of individual differences within patient groups that predict treatment response (e.g., [7,8, NITSCHKE JB, SARINOPOULOS S, OATHES DJ et al. ANTICIPATORY PROCESSING IN GENERALIZED ANXIETY DISORDER IS CHARACTERIZED BY UNIQUE AMYGDALA ACTIVATION THAT PREDICTS TREATMENT RESPONSE. Submitted]). Psychoactive medication use clearly affects the nervous system and issues stemming from comorbidities of psychiatric conditions and heterogeneity of symptoms within a diagnostic category further complicate our quest to find sensitive and specific physiological markers of psychiatric disorders. Methods exist to study emotion using neuroscience in psychopathology and to monitor treatment effects according to these methods. The Cognitive Neuroscience Society meeting is an ideal forum in which laboratories working on defining the affective neuroscience substrates of psychopathology can have their work evaluated and discussed by scientists with an established track record for studying complex issues inherent to mental processes with the use of neuroscience techniques. The interdisciplinary roots of the Cognitive Neuroscience Society invite this type of innovation and expansion of the scope of this meeting to incorporate clinically informative research. We therefore expect that Cognitive Neuroscience Society meetings in the next several years will include more treatment data from new researchers to this society as well as from affective neuroscience researchers expanding the scope of their studies to include patient populations.

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