Invited Symposium: Meet the Amygdala

August 27, 2004

A More Social View of the Human Amygdala
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Presenters
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William Kelley
Dartmouth College

Studies of the amygdala region of the brain have traditionally focused on its critical role in fear conditioning using animal populations. Recent research extends these findings to the social realm in humans. In the symposium, "More Social View of the Human Amygdala," examples of this innovative work was presented by Elizabeth Phelps, Andrea Heberlein, William Kelley, and Paul Whalen.

Phelps , New York University, addressed the role of the amygdala in two social means of fear learning, instructed fear and observation. She tested whether or not instruction or observation of fear would result in fear expression with subliminal presentation of the conditioned stimulus. She found that observational fear learning looked more like fear conditioning than instructed fear. "When subjects learned through observing another person in a fear conditioning experiment, they expressed this learning whether or not the stimulus was presented subliminally or supraliminally [below or above the threshold of consciousness]. With instruction, we didn't see any expression of fear when subjects were unaware of the presentation of the conditioned stimulus."

Phelps then examined whether there are more similarities in the neural systems involved in observational fear learning and fear conditioning than with instructed fear and fear conditioning. She found similar activation in the left and right amygdala and insular cortex in the expression and acquisition stages of observation and fear conditioning. For instructed fear, activation occurred primarily in the left amygdala. "These findings suggest that observational fear learning has both behavioral and neural similarities with learning through direct aversive experience," Phelps said.

Heberlein, University of Pennsylvania , focused on the role of the amygdala in anthropomorphizing. She discussed a patient with complete and specific bilateral amygdala damage. The patient had no difficulty in describing human stimuli with emotional and social language. However, the patient was unable to describe the social and emotional content of a film depicting animated shapes normally seen as highly social. The patient instead used predominantly movement-oriented words in her description of the video. These findings suggest that the "problem is not in accessing nor in correctly using emotional or social language," Heberlein said. "Rather, amygdala lesions reduce the human propensity to spontaneously

imbue the world with social meaning."

Kelley, Dartmouth College , spoke about how the amygdala responds during the experience of humor. He distinguished between two elements of humor: humor detection ("getting the joke") and humor appreciation ("enjoying the joke"). Kelley showed full-length Seinfeld and Simpsons episodes during two functional neuroimaging studies in an attempt to dissociate humor detection and humor appreciation. He found robust bilateral activation of the amygdala and insular cortex during humor appreciation and robust activation of the left posterior and middle temporal gyrus and inferior frontal cortex during humor detection. "The neural substrates of humor detection and humor appreciation appear to be dissociable and consistent across different genres of comedy," Kelley said. "Brain regions that seem to be dedicated to resolving contextual ambiguities are likewise engaged during humor detection. The mirth experience seems to depend upon brain regions necessary for emotional and visceral sensation."

Whalen, University of Wisconsin , pointed out that "Sometimes amygdala response is about what's not there. Sometimes responsivity is about context." In his research, Whalen measured responses to surprised facial expressions that were ambiguous in terms of valence. Subjects who thought the faces were negatively valenced showed high amygdala responsivity and low medial prefrontal cortex responsivity. On the other hand, subjects who viewed the faces as positively valenced showed high medial prefrontal cortex responsivity and low amygdala responsivity. In a follow-up study, Whalen added sentences ("She just lost/found $500") to make the valence of the faces less ambiguous. He found that the amygdala discriminates between positively and negatively cued faces.

To summarize the talks, Whalen quoted Darwin 's description of the diversified expressions of fear as "gradations of mere attention from a start of surprise leading to extreme terror." Whalen ended the symposium by noting that the amygdala behaves along this continuum and is responsive to a variety of subtle processes along with its different circuits.