# Context and personality key in understanding responses to emotional facial expressions

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It is well appreciated that facial expressions play a major role in non-verbal social communication among humans and other primates, because faces provide rapid access to information about the identity as well as the internal states and intentions of others. In his song, Mona Lisa, Nat King Cole reflected on the motivations for Mona Lisa's "mystic smile" and new data by scientists in Switzerland suggests that both the social context of a person's facial expression and certain facets of the viewer's personality could affect how our brain interprets the social meaning of someone else's smile or frown.

In a new brain imaging study published in the open-access journal *PLoS ONE,* Pascal Vrtička and colleagues at the Swiss National Center for Affective Sciences hosted by the University of Geneva found that visually identical facial expressions can produce different patterns of responses in emotional brain areas when context changes their social meanings, and that these patterns of social sensitivity are strongly modulated by individual attachment style (i.e. how a person emotionally perceives and responds to others during social interactions, thought to be either secure, anxious or avoidant). In this study, the specific brain substrates underlying these individual differences in reaction to emotional stimuli are identified for the first time.

Vrtička and colleagues manipulated the social significance of facial expressions by presenting them in different contexts while participants performed a pseudo-competitive game with virtual partners in the functional magnetic resonance imaging (fMRI) scanner. The virtual

partners could either be from allied or opponent teams and would display either a smiling or an angry expression in response to the success (or failure) of the participant. A smile could thus be perceived either as praising an accomplishment or mocking a failure, and a frown either as a sign of reproach or frustration.

When the virtual partners were seen as allies (i.e. smiling in response to the success of the participant or looking angry when the participant failed), happy faces activated the ventral striatum and ventral tegmental area (areas of the brain associated with reward processing), but this response was much weaker in participants with an avoidant attachment style. Angry faces, on the other hand, increased the activation of the amygdala (an area of the brain implicated in fear and arousal), especially in participants with an anxious attachment style. These activation patterns were very specific, because no response in reward circuits or amygdala was found for facial expressions of virtual partners seen as opponents. Instead, opponent's expressions led to increased activity in brain regions associated with theory of mind and alertness (superior temporal sulcus and anterior cingulate gyrus).

The findings extend previous research into social emotion processing by showing that specific expressions in faces are processed differently in the human brain depending on the personality of the individual and the social context where the faces are perceived.

Moreover, the data provide novel biological support for a link between an individual's attachment style and activity in brain systems implicated in reward and threat processing. Because both the ventral striatum and amygdala are key brain structures for learning and predicting motivational outcomes, they may play a critical role for the establishment of idiosyncratic affective responses to social cues based on past experience or developmental history. Vrtička and colleagues could for the first time capture the neural signatures of such behaviours by

showing that avoidant participant's brains responded much less to the rewarding value of social support, whereas anxious participants displayed increased threat- or distress-related brain activity to social punishment.

Vrtička and colleagues suggest that these data may ultimately help define appropriate intervention strategies in clinical disorders of attachment and social functioning, including social anxiety, social phobias and autism.

Citation: Vrtièka P, Andersson F, Grandjean D, Sander D, Vuilleumier P (2008) Individual Attachment Style Modulates Human Amygdala and Striatum Activation during Social Appraisal. PLoS ONE 3(8): e2868. doi:10.1371/journal.pone.0002868
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