

gut feelings

violation of moral imperatives, whereas shame results from a discrepancy between one's goals, standards, and aspirations and one's actual accomplishments. In the behavioural focus approach, guilt is differentiated from shame by a focus on a particular behaviour, rather than on the self in general. In guilt, the focus is on the specific act of wrongdoing. The person takes responsibility for the blameworthy behaviour, and is motivated to repair the damage caused. In shame, however, the negative emotion encompasses the whole self. The wrongdoing is seen as a manifestation of fundamental, uncontrollable defects in the self.

Recent cross-cultural research suggests that all four perspectives are valid, but for different kinds of situations or different phenomena related to guilt (Fontaine *et al.* 2006). While the internal standards, moral transgression, and interpersonal approaches describe emotional reactions to different kinds of situation, the behavioural focus perspective seems to describe an individual difference that generalizes across situations. The internal standards perspective applies to situations that may or may not involve moral deficiency but that primarily affect one's own outcomes, such as failing a course because of insufficient commitment to studying. Typical responses to this type of guilt are rumination and self-reproach. In the moral transgression approach, the situation may or may not involve other people, but always involves a violation of moral standards. The interpersonal perspective best describes situations in which a person unjustifiably causes someone else to suffer. Typical responses are a strong tendency to empathize and to attempt to undo the harm done. Unlike the other three approaches, the behavioural focus approach is not specific to any kind of guilt-inducing situation, but is a general personality disposition involving a sense of control, a focus on the specific act rather than on the self in general, and a tendency to take an active approach to reparation.

JOHNNY R. J. FONTAINE

gut feelings The term gut feelings has two meanings: one physiological and the other psychological. The more physiological meaning of the term refers to interoceptive (see INTEROCEPTION) perception of sensations emanating from the gut or internal visceral organs. These sensations can be caused by any number of conditions including acute illnesses such as food poisoning, chronic diseases of the intestines such as ulcerative colitis, or even cramps caused by dehydration.

Gut feelings also refer to various psychological states related to affect and emotion. The term is often used synonymously with intuition or the sense that good or bad consequences will come from a particular deci-

sion or event. When individuals feel that they possess intuitions about upcoming events they will often indicate that they have a 'feeling in their gut' even though they cannot put into words exactly how they know that something will come to pass.

There is a large literature that has tried to determine whether intuitions and gut feelings tend to be accurate or inaccurate. The answer is somewhat complex. On the one hand, doctors' and nurses' intuitions, and those of various other studied groups, do not seem to be nearly as accurate as their own confidence would suggest. Research on *decision-making suggests a whole range of biases that lead to systematic errors in judgement while producing feelings of intuitive correctness (Tversky and Kahneman 1974). On the other hand, there are various phenomena in which individuals are much more accurate than chance while relying only on their gut feelings. For instance, after being shown 2-second video clips, without sound, of college teachers teaching, individuals were able to tell with a remarkable degree of accuracy how those teachers were rated by students who had finished a semester long course with the same teachers (Ambady and Rosenthal 1993). In these 'thin slice' studies, subjects often report that they do not know how they answered and simply went with their gut feelings.

The fact that there are both physiological and psychological meanings of gut feelings could be a result of the way these processes interact with one another. The *James-Lange theory of emotion suggests that the experience of emotion, psychologically, was dependent on the perception of bodily signals, including those of the interoceptive variety. Similarly, cognitive dissonance theory (Festinger 1957) proposes that individuals change the way they feel about various things when they experience physiological discomfort caused by the conflict between their current attitudes and other conflicting beliefs.

Neuroscientists have also explored the links between the physiological and psychological aspects of gut feelings. One general finding of interest is that serotonin, one of the two neurotransmitters most commonly associated with affective processes in the brain, is more prevalent in the gut than any other region of the body. In fact, about 95% of the body's serotonin is found in the gut and is thought to transmit information to the brain (Gershon and Tack 2007).

Neuroimaging studies have also examined how the brain might incorporate information from the gut in its processes (see Fig. 1). These are complex processes that are just beginning to be understood. One prominent theory (Damasio 1994) has argued that the ventromedial prefrontal cortex learns, with practice, to predict

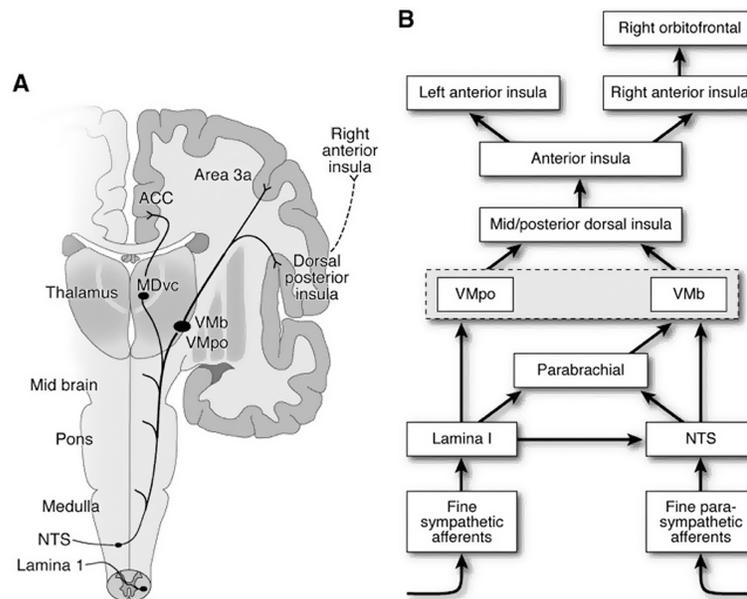


Fig. 1. Ascending projections of homeostatic afferents. (a) Organization of interoceptive pathways. Small-diameter afferents that travel with sympathetic and with parasympathetic efferents provide input to lamina I and nucleus tractus solitarius (NTS), respectively. In mammals, the activity of both types of afferents is integrated in the parabrachial nucleus (PBN), which projects to insular cortex. In nonhuman and human primates there exists a direct projection from lamina I and from the NTS to the ventromedial thalamic nuclei (VMpo and VMb, respectively). Neurons in these nuclei project in a topographical fashion to the mid/posterior insula. In humans, this cortical image of the homeostatic state of the organism is re-represented in the anterior insula on the same side of the brain. These re-representations provide the substrate for a subjective evaluation of interoceptive state. (b) Spino-thalamo-cortical system. Summary diagram illustrating the projections in primates of homeostatic afferent pathways from lamina I (spinal) and NTS (vagal) to thalamic nuclei, and the two cortical regions involved in the sensory (insula) and motivational (anterior cingulate cortex, ACC) dimensions of homeostatic emotions. Reprinted from Mayer *et al.* (2006)

how the body would respond to particular situations so that the brain can respond more efficiently to those situations without waiting for relatively slow feedback from bodily responses (see SOMATIC MARKER HYPOTHESIS). Work by Craig (2002), Critchley (2004), and others points to a neural network including the *anterior cin-

gulate cortex, insula, thalamus, and orbitofrontal cortex in the detection of gut feelings.

MATTHEW D. LIEBERMAN

Mayer, E.A., Naliboff, B.D., and Craig, A.D. (2006). Neuroimaging of the brain-gut axis: from basic understanding to treatment of functional GI disorders. *Gastroenterology*, 131, 1925-42.