Beyond Emotions in Designing and Designs: Epistemological and Practical Issues

Terence Love
Dept. of Design, Curtin University, Australia

There is increasing focus on non-rational issues in designing, and in users' responses to designed products, systems and services. Many designers and design researchers have pointed to the importance of feelings in designing and the ways that humans perceive and interact with designed outcomes (see, for example, Cross, 1990; Davies and Talbot, 1987; Galle and Kovács, 1996; Lawson, 1994; Liu, 1996; Love, 2001, 1998; Tovey, 1997; Tovey, 1992). Research into the neurological basis of cognition by Bastick, Damasio and others have pointed to non-rational affective processes (feelings and emotions) being essential to, and driving, human cognition, behaviour, values, judgment and agency – key issues in design research (see, for example, Badgaiyan, 2000; Bastick, 1982; Damasio, 1994; Karr-Morse and Wiley, 1997; Knight, 1999; Shore, 1997).

The increased attention to non-rational processes has been dominated by a focus on 'emotions' (see, for example, ISRE, 2001; Massachusetts Institute of Technology - Affective Computing Research Area, 1999; Petrushin, 2000; Susac, 1998), and in design research this has been mainly from a rationalist, cognitive science perspective as evident in, e.g. "The Cognitive Structure of Emotions" by Ortony, Clore and Collins (1988).

This paper suggests design research is better served by focusing on understanding the key roles that emotions and feelings play in designing through understanding the physiological processes, because traditional "emotion-based" approaches are likely to restrict understanding and block the development of key areas involving close integration between humans' actions and designed products (e.g. ubiquitous computing systems). Human affective processes, based on physiological mechanisms offer an epistemologically useful cornerstone for design research and point to a research programme and theoretical foundation that addresses many fundamental, and often unacknowledged, epistemological contradictions in design theory.

EMOTION IN DESIGN RESEARCH

Traditionally, affective aspects of designing have been addressed in terms of emotions and feelings - often regarded as synonymous (Susac, 1998). In line with cognitive science, emotions (non-rational) have been regarded as separate from, and in most cases consequent to thinking (rational) and perceiving. Translated into design theories, this has frequently resulted in emotions being regarded as a direct result of the attributes of objects, situations or designs, or more unhelpfully, as *actual* attributes of objects, situations or designs.

Philosophical inspection indicates the relationship between thoughts and affects/emotions/feelings is not simple. Rationality and analysis require a prior process, sometimes called "intuition" or "insight", that depends upon processes in the realm of feelings/emotions/affects (Bastick, 1982; Damasio, 1994; Rosen, 1980). Recent research into human physiological and neurological processes, especially that undertaken through fMRI scanning of brain activity, has confirmed that this is in fact, how humans function (Damasio, 1994). The picture that is emerging from brain research is that the cognitive and affective mechanisms underlying human thought, judgment, creativity, feelings, actions, and motivations result from well defined neurological, hormonal and physiological processes operating in a structured architecture. These systems are not, however, simple or singular. A large number of parallel neurological, hormonal and physiological processes fulfill specific roles, and at the same time are reflexively connected with each other and their elements have a high level of reuse in other systems. That is, the cognitive, motor and affective systems are at the same time relatively separate, yet highly interlinked with feedback from different parts of each to different parts of themselves and to other systems (see, for example, Damasio, 1994; Macaluso, Frith, and Driver, 2002; Sloman 1998).

Prior to contemporary evidence from brain research tools, Bastick (1982) proposed a model of human thought intuition and action that consists of multiple reflexive relationships between feelings and thoughts. Bastick defined "feelings" as an individual's conscious and unconscious perceptions of subtle dynamic changes in their physiologically-based, somato-sensory and somato-motor processes and states (e.g. blood pressure, muscle tone, hormonal flux, breathing rate, blood vessel dilation, body skeletal kineasthetics, skin potential and heart rate). From this perspective, "emotions" are concepts, cognitive artefacts, referring to particular physiologically-based, and somato-sensory patterns. For example, the emotion "fear" consists of a particular concept referring to a particular pattern of high heart rate, high blood pressure, tense muscle tone, with specific facial and bodily kineasthetics. Other physiological patterns can be similarly identified for the remaining emotions. A key aspect of Bastick's theories is the way affects/feelings and thoughts have a reflexive physiological relationship: thoughts result in feelings, and feelings, as physiological somato-sensory and somato-motor states, cue particular thoughts.

More recently, on the basis of increasing knowledge about brain processes, Damasio (1994) has argued that thinking and feeling are different reflexive-linked aspects of a single complex process also involving humans' motor systems. He

suggested that affective human systems are evolutionary building blocks, developed prior to and used as core aspects of, conscious reflective cognition. In other words, Damasio extended the multiple brain concept (that each person has and uses a brain that is a composite of brain elements from human, primate, reptile and other early stages of evolution) to include viscerally-based somato-sensory and somato-motor systems originating, in evolutionary terms, as the cognition and protection mechanisms (elementary brain) for earlier simpler lower-level organisms. Damasio postulated that physiologically, cognito-affective loops are doubled: sensation cues thoughts that in turn result in a secondary pattern of affects that in their turn cues other thoughts. For example, a pinprick results in conscious or unconscious thoughts that result in affects such as feeling faint (low blood pressure) that then cue other thoughts. Damasio's theories are confirmed by more recent brain research (e.g. Badgaiyan, 2000; Fabri, Polonara, Quattrini, and Salvolini, 2002; Kiehl, Liddle, and Hopfinger, 2000; Miller, 2000).

A DESIGN RESEARCH PROGRAM BASED ON PHYSIOLOGICAL AFFECTS

There are many key issues that are epistemologically problematic in design theory: e.g. creativity, why styling works, how designers collaborate, why advertising works, cultural differences in interpretation, and acquisition of skills in designing. All of these are dependent on internal human processes that give rise to them. The previous lack of primary data about human internal processes has forced theories and research to be formulated using the only data available: second hand information from observation of humans' external behaviours. I suggest that this is has been a wrong-headed approach that is as practically and epistemologically problematic as trying to work out the program code for a word processor on the basis of documents produced by it. Inferring how humans undertake designing or interact with designed outcomes solely on the basis of observing their external activity (e.g. by protocol analysis) has been a major epistemological and ontological weakness of design research and design theories.

The new brain findings offer direct benefits. For example, the physiologically-based models of affective cognition of Damasio (1994) offer a direct understanding of the way that metaphor and allegory shape designing, design processes and aesthetics. Thus far, these issues have been relatively unsatisfactorily described in terms of the parallelism of metaphorical/allegorical elements (see, for example, Indurkhya, 1992), which does little to explain how they contribute to affective and cognitive changes in individual designers and to dispositional changes in particular designed outcomes. Understanding how metaphor and allegory 'work' provides the basis for new design theories and design methods to improve design practices and outcomes.

Understanding the physiology of affects/feelings in human cognition, action and agency offers a significant advance, and the basis for a major change to the theoretical foundations of design research that can potentially resolve many paradoxes, improve epistemological clarity and coherence, and offer integration with theories and research

findings from related disciplines. In research terms, better theory about emotion/affects in designing and designs foreshadows improved clarity about other theory issues such as definitions of design (Love, 2001; O'Doherty, 1964). For example, it highlights the problems of using 'design' as if it has independent existence with intention and agency, e.g. "design has given the world a different..." Viewing designing in terms of the internal human processes also points up the weaknesses in using information theories and theories about problem and solution attributes as a basis for theories about designing (Love, 2001; Dilnot, 1982).

An alternative research and theory-building programme based on physiology must go beyond simply adding 'emotion' to otherwise rationalist research perspectives on designing and designs. In theory terms, such a research programme would involve three major changes. First, a theoretical framework that coherently includes relevant qualitative and quantitative biological, technical, social, environmental, ethical, aesthetical, cognitive and philosophical theories (Sloman, 1998). Second, definitions of key concepts (design, designing, design process, communication, collaboration etc) based on the physiological origins of human feelings, cognition, designing and object use (Love, 2001). Finally, but not least, a research approach in which theory making focuses on humans, rather than on external issues such as the attributes of objects, designs, problems, information or information flows (Love, 1998).

REFERENCES

Badgaiyan, R. D., 2000, Executive Control, Willed Actions, and Nonconscious Processing. *Human Brain Mapping*, **9**, pp. 38-41.

Bastick, T., 1982, *Intuition: How we think and act*. England: John Wiley and Sons.

Cross, N., 1990, The nature and nurture of design ability. *Design Studies*, **11**(3), pp. 127-140.

Damasio, A., 1994, *Descartes' Error: Emotion, Reason and the Human Brain*. New York: Grosset.

Davies, R., and Talbot, R. J., 1987, Experiencing ideas: identity insight and the imago. *Design Studies*, **8**(1), pp. 17-25.

Fabri, M., Polonara, G., Quattrini, A., and Salvolini, U. (2002). Mechanical Noxious Stimuli cause Bilateral Activitation of Parietal Operculum in Callostomized Subjects. *Cerebral Cortex*, **12**(4), pp. 446-451.

Galle, P., and Kovács, L. B., 1996, Replication protocol analysis: a method for the study of real world design thinking. *Design Studies*, **17**(2), pp. 181-200.

Indurkhya, B., 1992, *Metaphor and Cognition*. Dordrecht: Kluwer Academic Publishers.

ISRE. 2001, *International Society for Research on Emotions Recent Publications*, [html file]. International Society for Research on Emotions. Available: http://www.assumption.edu/HTML/Academic/users/tboone/isre/Rpub.html [2001, May].

Karr-Morse, R., and Wiley, M. S., 1997, *Ghosts from the Nursery: tracing the roots of violence*. New York: The Atlantic Monthly Press.

Kiehl, K. A., Liddle, P. F., and Hopfinger, J. B., 2000, Error processing and the rostral anterior cingulate: an event related fMRI study. *Psychophysiology*, **37**, pp. 216 - 233.

Knight, J., 1999, How stressful days steal your memories. *New Scientist* (26 June 1999), 6.

Lawson, B., 1994, *Design in Mind*. Oxford UK: Butterworth-Heinmann Ltd.

Liu, Y.-T., 1996, Is designing one search or two? A model of design thinking involving symbolism and connectionism. *Design Studies*, **17**(4), pp. 435-450.

Love, T., 2001, Concepts and Affects in Computational and Cognitive Models of Designing. In J. S. Gero and M. L. Maher (Eds.), *Computational and Cognitive Models of Creative Design*. Heron Island, Queensland.

Love, T., 1998, *Social, Environmental and Ethical Factors in Engineering Design Theory: a Post-positivist Approach*. Perth, Western Australia: Praxis Education.

Macaluso, E., Frith, C. D., and Driver, J., 2002, Directing Attention to Locations and to Sensory Modalities: Multiple levels of Selective Processing revealed with PET. *Cerebral Cortex*, **12**(4), pp. 357-368.

Massachusetts Institute of Technology - Affective Computing Research Area, 1999, *Affective Computing Research Areas*, [www]. Affective Computing Research Area, MIT. Available: http://www.media,mit.edu/affect/AC_research/ [1999, 1/6/99].

Miller, E. K., 2000, The prefrontal cortex and cognitive control. *Nature Reviews Neuroscience*, **1**(October), pp. 59-65.

O'Doherty, E. F., 1964, Psychological Aspects of the Creative Act. In J. C. Jones and D. G. Thornley (Eds.), *Conference on design methods* (pp. 197–204). New York: Macmillan.

Ortony, A., Clore, G. L., and Collins, A., 1988, *The Cognitive Structure of Emotions*. Cambridge: Cambridge University Press.

Petrushin, V. A., 2000, *Emotion in Speech: Recognition and Application to Call Centres*. Northbrook, Ill, USA: Andersen Consulting.

Rosen, S., 1980, *The Limits of Analysis*. New Haven: Yale University Press.

Shore, R., 1997, *Rethinking the brain: new insights into early development*. New York: Families and Work Institute.

Sloman, A., 1998, Damasio, Descartes, Alarms and Meta-management, *Proceedings Symposium on Cognitive Agents: Modelling Human Cognition, IEEE International Conference on Systems, Man, and Cybernetics* (pp. 2652-7). San Diego, CA: San Diego Cybernetics. Available: cogprints.ecs.soton.ac.uk/archive/00000717/00/Sloman_smc98.ps [2002, 28/10/2002].

Susac, D., 1998, *Emotional Machines: A review of Rosalind Picard's Affective Computing (1997, MIT Press)*, [www]. About.com Inc. Available: http://ai.miningco.com/library/weekly/aa070598.htm [1999, 2/6/99]

Tovey, M., 1997, Styling and design: intuition and analysis in industrial design. *Design Studies*, **18**(1), pp. 5-32.

Tovey, M., 1992, Intuitive and objective processes in automotive design. *Design Studies*, **13**(1), pp. 23-41.