HCI2005 Workshop on the Role of Emotion in HCI

What is affective sensing for?

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Many imagined applications of affective computing involve sensing users' reactions or affective states in order to adapt interaction in some way. For example, on sensing frustration, a system might offer components of active listening, empathy and sympathy to support users' recovery (Klein, Moon and Picard, 2002), or on sensing difficulty in understanding, a computer-assisted learning program might alter its teaching strategy (Conati, 2002).

One problem with these ideas, at least at the present time, is the low sensitivity and discriminatory ability of affective sensing techniques. Experiments have tended to be concerned with relatively strong stimuli and gross failures of usability. From the long-standing literature on psychophysiology (e.g. Andreassi, 2000), there should be no surprise that using an unreliable mouse whilst carrying out a competitive task (Scheirer, et. al., 2002), or the sudden appearance of an alert box during an online quiz (Ward, et. al. 2003), produce measurable changes in skin conductance. We have argued previously that in order to be useful in human-computer interaction, affective sensing has to be able to detect and interpret reactions to subtle events, not just major failures of interaction, and that it has to be able to detect these reactions in complex naturalistic situations rather than laboratory controlled conditions (Ward and Marsden, 2004). Reactions to subtle events, such as a user's liking for a particular image on a web site, or sense of satisfaction in completing a particular piece of work, are more difficult to recognise.

A further reservation concerns the balance of affective initiative. Most proposed applications implicitly regard the machine and not the user as having the initiative in affective interaction. There may here be some parallels with the authoritarian interactive style of 1980s intelligent tutoring systems which, whilst possibly of interest from a cognitive science perspective, were pedagogically ineffective (Sleeman, et. al., 1990; Laurillard, 2002, p143). As Picard and Klein point out, the user should be in charge, directly involved in setting the system goals, otherwise the system will quickly be rejected (Picard and Klein, 2002).

"Setting the system goals" is one function of emotion in the real world. Oatley (2000), describes one of the major roles of emotion as the management of co-operation between self-and-other. The expression of emotion helps guide and motivate social partners towards the completion of shared objectives. This function of emotion develops during infant attachment behaviour, which is managed through expressions of assertiveness, affection and anxiety. There would appear to be connections here with other ideas in interpersonal psychology such as transactional analysis where assertiveness is equivalent to "parent", anxiety to "child" and affection to "adult" ego states (Williamson and Ward, 1999). Assertiveness and anger emphasise demands. Affection and happiness encourage and reward co-operation. Anxiety, fear and sadness elicit empathy and support, express deference, and direct attention to threats and safety. Furthermore, these emotions are often communicated deliberately, in a heightened way, so as to ensure their recognition and comprehension. It should not be too difficult for an affective machine to recognise intentional, accentuated expressions of emotion, especially using probabilistic combination of multiple sources of evidence (e.g. Kapoor, et. al. 2004).

Could intentional communication of emotion be useful in affective computing applications? What sort of interactions between self-and-computer might it support? In what kind of collaborations might it be applied? Existing forms of affective interaction might provide useful analogies. Table 1 employs the assertiveness-affection-anxiety framework to examine existing collaborations with a view to identifying possible models for affective human-computer interaction. These situations involve intentional, often accentuated, communication of emotion to others, human and non-human. The list is probably incomplete, but all seem to

assume that the "other" is a sentient being with some degree of autonomy, with an ability to form opinions about us, about which we are concerned. People do seem willing to entertain these beliefs about computers (Brave, et. al., 2005; Prendinger, et. al., 2005). Any of these models, implemented in machine form, would involve the machine sensing the user's expressions of emotion in order to adapt its own behaviour.

Partner model	Intentional Communication of Affect			Why?
	Assertiveness	Affection	Anxiety	
1. The machine	strong	strong	strong	Catharsis?
2. The servant	strong	none	none	To control
3. The pupil or apprentice	moderate	weak	none	To control and to help
4. The pet or working animal	moderate	strong	none	To control and to share
5. The child	moderate	strong	moderate	To control, to share and to help
6. The partner	weak	strong	moderate	Sharing
7. The teacher	weak	weak	moderate	To seek help and approval
8. The manager	weak	weak	weak	To seek reward and approval
9. The master	none	none	none	To avoid conflict

Table 1: Models for applications based upon users' intentional expressions of affect.

The following notes refer to the models in Table 1:

1. Machines do not recognise or respond to emotions, but their operators still sometimes abuse, encourage or express anxiety towards them, sometimes very strongly. Imagine yourself as the driver of a car, low on fuel, miles from a petrol station. This model includes non-affective computers.

2. Servants do recognise emotions but do not respond other than perhaps minimally to acknowledge them. They respond to instructions, but codes of conduct prohibit the return of any emotion (e.g. Channel 4, 2004). Victorian schoolchildren were similar, supposedly expected to obey without question, and not to initiate any non-essential communications of their own (Urban Legends, 2000). Their masters and mistresses possibly regarded Victorian servants and schoolchildren little differently from machines, but hopefully with more respect, using less extreme expressions of emotion than with machines.

3. Pupils and apprentices also recognise emotions. They need to be directed confidently. Their performance responds positively to encouragement and approval (positive reinforcement), less so to criticism and disapproval (negative reinforcement).

4. Pets and working animals recognise basic emotions. They need to be directed calmly, confidently and sometimes strictly, they need to be shown praise, warmth and affection and react very badly to anger and abuse (e.g. Littlehats, no date).

5. Children may in some ways be similar to pets but are also skilfully able to manipulate adults' emotions. They require considerable structure and stimulation, and warmth and praise for the positive. Bad behaviour can be addressed through distraction using humour, and also by temporary withdrawal of attention through being ignored or time-out periods (BBC Three, 2005).

6. The partner. These have similarities with all the above, but respond best to love and sharing. They may also have similarities with the following.

7. Teachers are similar to managers, below, although the expression of uncertainty or anxiety tends to invoke their helpfulness.

8. Managers seek deference and respect rather than affection. They may not respond well to assertiveness, although sometimes calm assertiveness, rather than passiveness or aggression, may be necessary. They may also respond well to the sharing of positive emotions such as enthusiasm, and avoidance of negative emotions (the-centre, no date).

9. Masters should not be the recipient of any intentional emotional communication. They can detect unintentional betrayals of emotion, and will themselves decide how this should be dealt with.

Hopefully the above does not betray the author's naïve and idiosyncratic grasp of relationships. The models would appear to differ along a number of dimensions: the degree of control over the other, the degree to which one reveals oneself for mutual sharing of emotionality, the extent to which expressions of emotion form an intentional response to the other's behaviour. At present non-affective computers would seem to fall into model 1, experiments with affective interaction into model 9, and some ideas about possible applications into model 7, but could the range of models suggest other applications of affective computing for the future?

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