Emotional Interaction

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ABSTRACT
This paper discusses the association of emotions as an underlying component of everyday human-computer interaction. It presents the ongoing work in the design of an experiment to help understand the role that cognitive or appraisal theory of emotions might have in shaping the human-computer dialogue.

Keywords
Affective computing, appraisal theory of emotion, emotional response

INTRODUCTION
Humans deal with emotions on a continuous basis and emotions are intrinsically part of our intelligence, part of the social interaction and the ability to make decisions (Damasio, 1995).

The CHI community aims at developing machines that are centered on the human needs. Though the emotional aspects of interaction have been for the most part acknowledged they have yet not been thoroughly studied.

There might be several explanations for this lack of consideration. We all know how hard it is to interpret, anticipate, and direct emotions in human-human interaction. How much harder must it be to try to achieve similar goals between the less compatible humans and machines? Through other point of view one could argue that it's totally senseless to provide machines with any sort of emotional awareness or expressiveness, as they are machines and therefore just merely tools to be used. In respect to this argument, the reality though seems to be different. Even with some basic interactions, several studies have shown that humans exhibit social behaviors when interacting with computers (Reeves & Nass, 1996). Looking to more advance interactions emerging from the robotics field (Breazeal, 2000) the presence of emotion then seems to be intrinsic to the interaction itself.

If we acknowledge a future where computers in different forms and shapes have a ubiquitous presence, increasingly incorporated in the daily activities, but ignore the user's emotional responses, aren't we in risk of having some sort of machine "autism": unable to interact sociably and "self-absorbed" with repetitive behavior ? In a humorous tone we could recall the Microsoft® Word Clip as a preview of such occurrence.

This paper briefly introduces the existing cognitive theory of emotion also known as appraisal theory of emotion, and describes the ongoing study to understand the role of this theory in the human-computer dialogue.

MODELS OF EMOTION
In order to understand the role of emotional behavior in human computer interaction it is necessary to understand the fundamental aspects of emotion itself. A look into the literature from the field of psychology concerning emotions quickly reveals that it has been a fundamental topic of research for a long time. Nevertheless it is a topic with many open questions, including the question: "what is an emotion?"

Appraisal theory has become one of the most active approaches in the domain of emotional psychology. According to the appraisal theory of emotions, the emotional responses results from a dynamic evaluation (appraisal) of needs, beliefs, goals, concerns, environmental demands that might occur consciously or unconsciously. Several theories have been proposed, but all converge in the view that a specific set of properties of antecedent events defines a particular emotional outcome, see (Roseman & Smith, 2001) for an overview. For example, Roseman's model, proposes seven appraisal dimensions of events directly influencing emotions: unexpectedness, situational state, motivational state, probability, agency, control potential, problem type (Roseman, 2001). Applying those, or similar appraisal dimensions proposed by the different theories, and relate them to aspects of the interface or interaction, constitutes an interesting basis to anticipate the user emotional experience towards an interactive system. Also, given the user experienced emotion towards some event triggered by the interaction, it might prove feasible to identify the causes, as a combination of the user evaluation of the event along the different appraisal dimensions.

FACIAL EXPRESSION OF EMOTION

The study of facial expression of emotions dates back to the work of Darwin on the universality of expressions of emotion. More recently, the work by Ekman & Friesen (1978) facilitated the study of facial expressions with the development of a system based on objective visible facial changes (facial action units) to categorize facial expression, known as FACS (Facial Action Coding System). The interdependency between the evaluation outcome of the appraisal dimensions and specific facial expression patterns was addressed by Scherer (1987) in his component process model of emotion. The refinements of this theory see for details Kaiser & Wehrle (2001), constitute the basis for the proposed work.

DESIGN OF AN EMPIRICAL STUDY

A protocol for an empirical study is currently being developed to test the hypotheses of a computer identifying the user's facial signs of appraisal towards an event in the context of human computer interaction. Two techniques to monitor facial expressions will be employed, EMG (Electromyogram) sensors and video monitoring. EMG offers higher sensibility to muscular activity it provides an accurate base to compare against the less obtrusive video monitoring. The video from the subjects will be classified using the FACS system. By having two groups of subjects we will be able to compare the performance of one sensing technique against the other.

For each subject, the experiment will be divided in two parts, calibration and testing. For the calibration, the computer game Tetris was chosen because of the simple rules and limited environment to present a set of stimulus in a randomized order in between periods of normal game play. The stimuli were chosen to manipulate a subset of Roseman's appraisal dimensions: unexpectedness, situational state, agency and control potential. Examples of the stimuli are: keyboard stuck, very quickly falling blocks, rows that disappear even if not completed. For each of those events the FACS scoring and the EMG signal features are recorded and related with the corresponding appraisal dimension manipulated. The data collected in this stage of the experiment is used to identify facial indicators of appraisal processes in the second part of the experiment.

The second part of the experiment resembles a typical computer use scenario. The subject is asked to execute a list of tasks in the word-processing software Microsoft® Word 2000 in a limited period of time. The tasks are chosen to cover a range of difficult levels. The user, for a variety of reasons including the software usability issues, familiarity and experience with the application may experience difficulties executing some of the tasks. For those problematic interactions that are accompanied by facial activity, the EMG data and the FACS scoring are compared against the data collected during this first part of the experiment. The goal is to identify the appraisal dimensions involved: unexpectedness, situational state, agency and control potential. To validate the results, the subject is given a questionnaire to identify the tasks that caused difficulties and indicate the appraisal process elicited during those events.

CONCLUSION

This paper presents ongoing work to explore how, during human-computer interaction, the facial expressions signaling the appraisal process of emotion reflect the quality of the user's experience and how can that information be applied to better support the user.

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