**Proposal of Study: Affect Modeling Framework for Educational Software**

Through my previous research, I reasoned that in order to create efficient educational software we should expand the notion that technology is just a tool to take into consideration learners’ emotional needs (see also Bates, 1994; Busso et at, 2004; Johnson et al. 2000; Gratch & Marsella, 2001; Norman, 2004; Nasoz et al, 2004; Picard, 1997; Picard & Klein, 2002). In fact, the “question is not whether intelligent machines can have any emotions, but whether machines can be intelligent without emotions” (Gratch & Marsella, 2004, p. 301). Humans interacting with machines have emotional needs that are not yet addressed by current systems (Neyem et al. 2007; Picard & Klein, 2002). One of the findings of my previous research was that even if emotional design was considered to be important to my participants, there is little evidence of awareness of this in the IT community. The participants in my study strongly supported and encouraged more research into emotional design.

**Proposed Study**: I intend to design a framework for creating pedagogical agents for educational software to model both student affect and learning. Extending from my MA research, I am in the process of evaluating existing emotion-cognition theories used for emotion recognition and modeling, and for designing intelligent-affective agents: cognitive theories, appraisal theories, Ekman’s framework of basic emotions, dimensional models (i.e., the dimensional model of emotion using arousal and valence developed by Russell and Barrett (1980) and Rolls’ (2000) emotion framework based on reinforcement), and the OCC model used for emotion synthesis in artificial intelligence (Ortony, Clore, and Collins 1988)]. I intend to generate a framework using the experience gained from the development of emotion classifiers and techniques for affect analysis by scholars like Busso et al. (2004), Fellenz et al. (2000), Gratch and Marsella (2001), Pantic and Rothkrantz (2003), Sebe and Lew (2002), Zhu, De Silva and Ko (2001) and from the field of intelligent tutors (Conati, Gertner, & VanLehn (2002), Conati & Maclaren, 2009; Mayo & Mitrovic, 1999; Mitrovic & Ohlsson, 1999; Shute & Glaser, 1990).

Although progress had been made with respect to emotion classifiers, emotion recognition, and affect analysis in the context of adaptive interfaces, very little has been done with respect to the intelligent tutor’s response when emotion is detected. With few exceptions (i.e., Conati’s and Maclaren’s affect-modeling framework), intelligent tutors are based only on cognitive models. My goal is to employ affect and learning theory to fill this gap by formalizing an analytical model to describe the dynamics of a learner’s emotional states and determine what response should be given to the learner when emotion is detected. In order to be effective, the response should be based on both assessment of student knowledge and evaluation of affective states.

I will to employ design-based research methods by combining qualitative and quantitative paradigms and empirical research with a theory-driven design enrolling as participants teachers and students. In the first phase of the study, a framework will be built based on a qualitative study that will involve teachers and expert tutors. The result of my efforts will be an emotionally intelligent agent that I will integrate into an existing mathematical educational game for learning prime numbers (PrimeClimb) developed at UBC (Conati and Maclaren, 2009). To evaluate the performance of the emotionally intelligent agent, a user study will be conducted with 50-60 students from grades 5 and 6. The research design of my MA thesis utilized an explanatory mixed QUAN-QUAL methodological model that I derived from Creswell (2003) and Gay, Mills, and Airasian (2006). Similarly, for this study, I will utilize a QUAL-Quan model with qualitative data derived from observation and open-ended interviews followed by a design experiment to validate the concepts derived from qualitative analysis using quantitative techniques.

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