Transfer of Social Human-Human Interaction to Social Human-Agent Interaction

Doctoral Consortium

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ABSTRACT

Interdisciplinary work between psychology and computer science allows to examine the transfer of social human-human interaction to social human-agent interaction. This paper presents our ideas about the development of a computational model of emotions relying on an emotional model that differentiates between structural, communicative and situational emotions.

KEYWORDS

Social Agents, Computational Model of Emotions, User Studies, Interdisciplinary Work

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1 INTRODUCTION

Since Rosalind Picard's pioneering book [16], research in the area of Affective Computing emphasises the importance of providing emotional abilities to computers. One facet of this is to equip interactive virtual agents with social skills, like understanding and showing emotional reactions. In human-human interactions, people rely on their emotions for managing different kinds of situations [6]. Similar observations can be made for social human-agent interaction. Human communication strategies in human-agent interactions resemble those in human-human interaction [10]. Considering both, it is reasonable to conclude that emotions play a critical role in creating engaging and believable characters [7]. Even more, digital companions must have an understanding of the human partners' emotions as a basis for a human-companion relationship [19]. Especially for designing social training applications, the understanding of how emotions work is important [9].

For agents exploited successfully for social trainings, two areas seem to be important: 1) knowledge about how humans build relations; 2) development of a computational model of emotions. To shed light on these two areas, the examination of the transfer of social human-human interaction to social human-agent interaction can be a starting point.

Research on computational models of human emotions experienced a significant expansion in the last decade [17]. The majority focuses on cognitive appraisal theories for emotions, e. g. EMA [13] or FearNot! [1]. Besides appraisal, regulation of emotions is one focus of cognitive emotion theories [8]. Some emotional models are able to handle the regulation of basic emotions by representing basic regulation rules [12] or re-appraisal [3]. However, none of the current models of emotions separates between different origins of emotions, proposed by the emotion theory of Moser and von Zeppelin [14]. In their work, they differentiate three categories of emotions: internal (structural) emotions, communicative emotion and situational emotions. Structural emotions encompass internal affective information, which serves to prepare for action and the regulation. Communicative emotions occur in real interaction and provide the interaction partner with an emotional message. Situational emotions are an appraisal result of a dialog topic. Moreover, they propose that regulation processes can be presented as procedures of a cognitive-affective organisation. The parallel processing model is organised in modules that have multiple networks [15]. In our emotional model, we want to include this view of regulation processes as well as the differentiation of emotion categories. We hope that this model will bring us closer to a more complex user model with which we can predict possible structural emotions, a cruicial aspect for an empathic reaction of a social agent.

2 RESEARCH QUESTIONS

In my doctoral research, I am examining the transfer of social human-human interaction to social human-agent interaction focusing on shaping the relation between human and agent as well as building a computational model of emotions. I developed the following research questions: 1) Do people build a relation to agents? To answer this question, we conducted three studies examining social mimicry in human-agent interactions, social embarrassment for agents and building alliances with agents. 2) Show humans in human-agent interaction similar emotions like in human-human interactions? To answer this question, we are conducting a study comparing a human-human interaction with a similar human-agent interaction invoking the structural emotion shame. The goal is to compare the participants' emotional reaction and to find out if regulation processes are shown both with a human interaction partner and a virtual agent. Based on the results of the ongoing and planned studies, we will try to implement Moser's emotion theory [14] in a computational model of emotions. This computational model will be further developed to model knowledge that is crucial to implement empathically reacting agents.

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3 METHODOLOGY

3.1 Use-case

In the last three years, we have developed a job interview use-case in the EmpaT project[1] aiming to represent the whole interview process. A job interview is a highly evaluative situation for applicants [11] and may elicit specific strucural emotions like anxiety or shame. In order to simulate an experience as realistic as possible, the infrastructure and buildings have been faithfully reproduced in a 3D environment. Besides, the world has been enlivened by non-player characters, which can also be used interactively to a limited extent, for example at the reception desk or to simulate a particular working atmosphere. It is possible for users to navigate through the 3D environment starting in front of the company, going at the reception desk, waiting in the lobby, going in a meeting room or office, and leaving again. In all those stages, users can observe the daily routine of the simulated employees. Three high-quality life-like avatars (Figure 1) can be used to create different key roles, such as a human resources manager, an employee, another applicant or an external coach in a further building [5].

Figure 1: Social Agents.

3.2 Technical Set-up

We mainly exploit two components to create an adaptive-reactive controlling of the three main avatars: 1) a real-time social signal interpretation framework [18], 2) a behavior and interaction modeling and execution tool [4]. By detecting the users' emotional expression in real-time through voice, gestures and facial expressions, the integration of these two components allows a natural interaction between a user and an agent.

[1] www.empat-projekt.de

3.3 Lab Set-up

In order to conduct insightful user studies, we built a lab set-up in which we can observe and compare human-human interactions and human-agent interaction. Making use of two depth cameras and head-mounted microphones allow the detailed analysis of gaze, eyes, hand and body movement as well as the speech of both interactants (Figure 2). To reduce the experimenter's bias and to have a realistic scenario, we developed the Study Master, a remote control for the 3D environment and the agent. In the (mostly role-play) scenario that is used for the study, the Study Master makes it possible for the user to enter alone in the lab, that can represent for example the office of the job interviewer.

Figure 2: Lab set-up for user studies.

4 FUTURE WORK

In the next three years, we want to validate our computational model of emotions in more user studies. In these studies, we will compare the interaction between a user and a virtual agent with the interaction between a user and a human roleplayer in different situations. Another part of our work will be the extension of our model by taking dyadic processes like prototypical affective microsequences [2] into account. Moreover, we plan to implement more social training scenarios to reach broader generalizability for our emotion model. Specifically, we intend to develop an empathic mobile work-life balance coach in one of our next projects.

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