Conveying Social Relations in Virtual Agents Through an Emotion Sharing and Response Model

(Extended Abstract)

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1. INTRODUCTION

The impact of social relationships in human behavior is a complex topic but it is an important aspect to consider when creating believable agents. To achieve more believable social relations, we focus on a phenomenon of human interaction that is tightly coupled to social relationships but has been overlooked in most agent models of emotions: the "social sharing of emotions". It corresponds to a common daily event where a person, the sharer, tells another, the listener, about an emotional episode he experienced in the past. This phenomenon happens on a daily basis and it is important for social relationships as it signals some level of intimacy. Therefore, we propose an agent model that endows agents with the capability to speak about their past emotional experiences, and provide a supportive response in case they are the listeners.

For evaluation purposes, we developed a case study that consists in a simulation of a distressful situation in a 3D environment involving three autonomous characters. Two variations of this situation were designed: one in which our model causes a character to share the negative emotion it experiences and another where the character does not share any emotion. An user study was then conducted to assess the impact of the emotional sharing concerning the characters' believability and perceived relationship with each other.

2. EMOTION SHARING AND RESPONSE MODEL

Our model, as presented in Figure 1, considers both the sharer of an emotional episode and the listener of the episode itself. Whenever a new perception is sensed, the *Perceive-Appraisal Emotional Storage* process decides how that event will affect the agent's internal state. The main responsibility of this process is to store emotional memories in autobiographic memory and strengthen existing ones based on emotional cues, leading them to be shared later.

Subsequently, the *Emotion Sharing Activation* process will then decide if it is appropriate to share an emotional episode in the current situation. It will decide with who, when and what will be shared. The choice of the emotional episode to
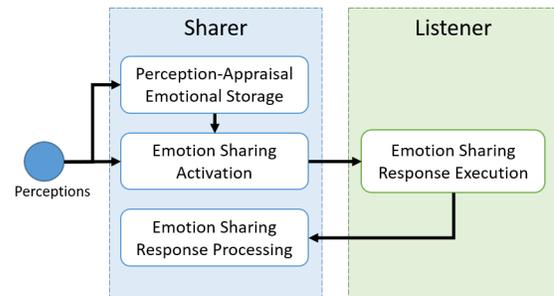
Figure 1: Emotion Sharing and Response Model

share from the autobiographic memory is done by favoring negative memories over positive ones, and later by finding the one who has the strongest event associated. Concerning the target that will be chosen to share, the choice is based on the agent's current social relations. More precisely, the chosen agent will be the one that is liked the most among the agents that have a positive relationship score. This decision is in line with the findings that indicate that people choose to share with who they have strong bonds [6]. If the emotion sharing process is enabled, the agent will share the emotional episode chosen with the target verbally, through a dialogue mechanism that is based on templates (see [1] for more details). Moreover, the act of sharing will make the agent remember the eliciting emotions regarding the episode.

On the listener side, the shared episode will activate the *Emotion Sharing Response Execution* process. First, the listener agent uses an *Empathic Appraisal* mechanism, based on the one described in [5], to generate an empathic emotion. If the listener has a negative social relationship with the sharer, then the listener will reject support, otherwise the listener will provide support. There are two types of supporting strategies that the listener agent might follow: (1) socio-affective or (2) cognitive work stimulation. A socio-affective response is performed if the shared emotion is positive or, in case it is negative, if it emphatically affected the listener agent. This is performed by expressing the empathic emotion and by generating a speech act such as "oh, that was really bad.". Otherwise, a cognitive work stimulation strategy such as resignation will be applied. If the shared episode is negative and contains one event corresponding to the activation or failure of a listener's goal then the listener will perform a generic speech act such as "Nevermind that, there's

nothing you can do about it". The number of episodes an episode has been shared is used as a modulation factor for the emphatic process. This is very important to allow the emotion sharing response to change accordingly. The first time a listener hears a new episode it will more likely choose to perform a socio-affective response. However, if the sharer continues sharing the same emotional episode, is because the initial response was not appropriate to provide emotion recovery, and thus a more complex cognitive strategy should be provided.

The final phase is performed by the sharer of the emotional episode when it receives the listener's response. In case of a rejection response, the social relation towards the listener drops and a new negative emotion that concerns the failure of the emotion sharing process is created. When it comes to a support sharing response the social relation towards the listener increases and a new positive emotion is created. If the support response is of the cognitive work stimulation type, the autobiographic memory will be affected by decreasing the emotion value associated. When the emotion value becomes below a certain level, the event will then be removed from memory.

3. CASE STUDY AND EVALUATION

The proposed model was integrated into an the emotional agent architecture FAtiMA[2]. The resulting architecture was then used to drive the behavior of three different characters (the Ticket Inspector, John and Peter) in a social simulation that takes place in a virtual train. Two versions of this simulation were built, one in which both John and Peter have the emotion sharing model and another version in which they do not.

In the first part of the narrative the Ticket Inspector asks for John's ticket. Without knowing, John presents him a ticket that has a different destination for where he wants to go. Ticket Inspector notices the mistake and forces John to pay a fine (making John sad). Afterwards, Peter (John's friend) appears in the train. He sits right next his friend, starting a conversation with him. Now, in the version with the emotion sharing model, John decides to share the fine situation with Peter. Peter then chooses to support him socio-affectively (since John is his friend and it is the first time he shares that situation with him). This part ends by having them going to the train bar. In the final part, John and Peter return to their places and continue talking with each other. At some point in time, the Ticket Inspector will pass by in front of them. John will recognize the Ticket Inspector, which will revive the fine situation felt and make him share again. Given that it is the second time the same episode is shared the intensity of the emphatic emotion is much lower and so Peter decides to adopt a cognitive work stimulation strategy of type resignation.

Using the case study an evaluation was conducted to measure the impact of the proposed model in the perception of the characters' believability and the characters' social relations in the train scenario. The evaluation was performed through the online Mechanical Turk platform[1]. Participants were randomly assigned to watch a video of the version of the simulation with the emotion sharing model or a video of the version without. They were then asked to fill out a questionnaire about the characters. Concerning the questions

of the survey, they were divided in two groups: believability, and Friendship Attachment. The believability questions were based on the work of Gomes [3]. The friendship attachment questions quantity the relationship between John and Peter in the eyes of the user. For this section, we adjusted McGill Friendship Questionnaire (MFQ) [4].

In total, 60 participants responded to our questionnaire. 34 participants were male while 26 were female. Only 6 of the participants were under 26 years old, while the rest were between 26 and 40. Given that the data did not follow a normal distribution, we applied the Mann Whitney U test and found statistically significant effect for the following variable: Friendship attachment of John towards Peter, $p=0.000$ with $r = 0.49$ (effect close to strong). There was no statistically significant difference for all the other variables tested. The results show that users indeed perceived John as having a stronger relationship towards Peter in the version with the Emotion Sharing and Response Model.

The fact that there were no differences in the user's perception of Peter towards John can be explained by the fact that in the version without the model there was no opportunity to illustrate an unsupportive behaviour by Peter, since there was no Emotion Sharing process by John in the first place. As such, to properly evaluate the response part of the model, we would need a third scenario where John performs Emotion Sharing but Peter responds negatively. Regarding believability, users found both versions equally believable. On hindsight, it seems that it was not clear to the users the exact degree of friendship, and thus both versions portrayed behaviour that was considered reasonable by users.

Acknowledgments

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