

**DISCLOSURE WITH AN EMOTIONAL INTELLIGENT SYNTHETIC PARTNER** F. Meijerink<sup>1,2</sup>, P.-P. van Maanen<sup>1,3</sup>, A.J. van Vliet<sup>1</sup>, A. Nijholt<sup>1</sup>. <sup>1</sup>TNO Human Factors, The Netherlands <sup>2</sup>University of Twente, The Netherlands <sup>3</sup>Vrije Universiteit Amsterdam, The Netherlands

**1. Introduction:** To talk and write about one's feelings has a beneficial effect on one's physical and psychological health (Pennebaker, 1997). More specifically, conversation evoking disclosure of emotions and traumatic events has a positive effect on one's health, rather than chitchat. Astronauts on a mission are exposed to stressful situations, without the presence of a therapist or even comfortable communication with home base. Given that it is important one is able to express one's feelings regularly, this situation clearly is a threat to success of enduring space missions. In this paper we discuss using an emotional intelligent relational agent to help solve this problem.

The present study focusses on written dialogues between a human subject and an emotional intelligent relational agent, which we call the *Synthetic Partner (SP)*. The central idea behind SP is that it acts as an interactive diary that gives emotional feedback to the subject. It constitutes conversations evoking disclosure combined with intelligent diary information retrieval during missions. The interface provides a means to express oneself with regard to particular events or daily affairs. SP's emotional feedback is based on an emotional content analyses of the current and past conversation with the subject.

**2. Requirements:** In order to obtain disclosure it is important that the agent meets certain requirements. One of the most important properties of a relational agent is the ability to acquire the subject's trust. The process of trust involves credibility. The credibility of the agent is increased by performing reflections of the person it is talking to (Bailenson & Yee, 2005).

Additionally it is important that an agent behaves as expected or explainable afterwards. Since relational agents are not intended to replace immersed psychotherapists, this implies that the user's expectations of the agent should be limited. The subject somehow has to be aware of the fact that the interaction is agent-based, while disclosure still is prominent.

It has also been indicated that people can have feelings for inanimate objects. This is more specifically also the case concerning interaction with computers (Reeves & Nass, 1996). In order to establish a long-term human-computer relationship, one needs at least a basic conversational interface (Bickmore & Picard, 2005). The human-agent relationship can be compared with the traditional patient-therapist relationship or friend-friend relationship (Bickmore & Picard, 2005). This gives room for attempts to replace human-human with human-agent relationships, when human-human relationships are less evident.

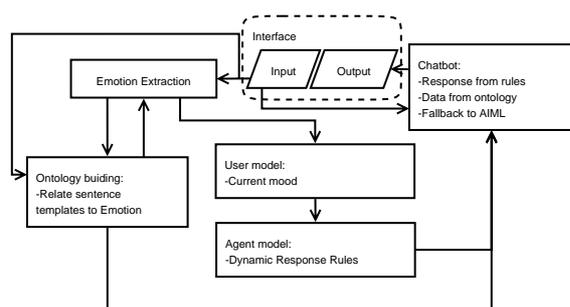
A relationship is defined as "a concept as referring to two people whose behaviour is interdependent, in that a change in the state of one will produce a change in the state of the other" (Kelley et al. 1983). In order to support such a relationship by software, state models of both subject and agent need to be obtained and maintained. Because relationship patterns are not defined by a general stereotype, and rather are unique for every relationship (Berscheid & Reis, 1998), the agent will have to comprise some kind of adaptive system to keep track of the subject's and agent's state of mind. The subject model should at least determine the subject's emotional state to which the agent model can be adapted. The agent model should be similar: It should generate output according to its emotional state, which is supposed to alter the subject model after further conversation. Additional subject's feedback can be used to ensure correct conversational response behaviour.

In, for example, clinical psychology, counselling and coaching, trust and engagement are important factors of success (Okun, 1997). It is also important, that during the course of interaction, the progress of this relationship is being examined (Bickmore & Picard, 2005). This emphasizes the importance of the agent's obtaining and maintaining a valid subject state model. No subject will feel understood if the subject is fact understood to a certain degree. At least the agent should be capable of maintaining a conversation and should continue to do so on the subsequent moments. By maintaining a conversation (even without a goal) a bond between agent and subject is created (Bickmore & Picard, 2005).

**3. Design:** Following the requirements, a design of SP is proposed (Figure 1). The basis will be a *Chatbot* based on AIML (Wallace, 2004) that can receive input in natural language and reply according to sentence patterns. The interface is such that it resembles a chat environment, in which input is given through keyboard input. Without extension, this system is able to reply with a fixed sentence or by manipulating the user input. This will result in tedious and repeated conversation. To remedy this, this system is extended. In parallel the *Emotion Extraction* module extracts emotionally affiliated content from the input and produces an emotional state (Ortony, Clore, and Collins, 1990). This emotional state is used to update the current mood in the *User Model* module. Mood is considered an emotional state which is more stable over time. In the *Ontology Building* module a world ontology is built simultaneously. It stores new emotionally featured sentence patterns, in order to facilitate emotion extraction. For example, in Figure 2, in Example 1: in general, "drill" is not affiliated with

any emotion, however, SP has detected that for this user it is. In turn, the ontology can supply useful background information to the *Chatbot* to refer to previous events. In Figure 2, Example 2 demonstrates how previous events (yesterday) can be used to refer to when discussing a specific emotion. Additionally, it stores user-supplied facts. The *Agent Model* contains a set of response rules which will feed the conversational model. These rules contain information about the way response is directed. For example, sadly annotated input requires an empathic response, and angrily annotated input requires further interrogation. In Example 3 of Figure 2, the emotion “sad” is recognised. SP replies empathically and encourages the user to tell more.

Emotional feedback is realised by the *Chatbot* module by extending AIML in a way that it can contain emotionally annotated AIML <template> tags, in a way similar to MyEliza (Fitriane, Wiggers, and Rothkrantz, 2003). The agent model is consulted to choose a valid empathic response and the ontology is used to query information that is used in the response templates.



**Figure 3.** The Synthetic Partner Design.

**4. Conclusions:** The goal of the present research is to eventually develop an emotional intelligent conversational agent that facilitates disclosure, for example in astronauts on enduring missions. In this paper the requirements for obtaining disclosure effects are discussed. A conceptual design has been proposed that combines several techniques in one system, in distinctive components. It combines existing emotion recognition and reflection technology, which attribute to the user’s empathy, with natural language processing, which enables the agent to store the semantic content into an ontology. With this combination, we aim to contribute to disclosure and will continue to do so on the long-term, without falling back into a repetitive conversation.

Little longitudinal research (over a course of more than one month) has been performed concerning the effectiveness of relational agents in psychological support systems. We propose to use a

system based on the presented design for such research. This might be done by using off-line questionnaires or on-line, using an automated feedback system.

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|----------|---|
| 1. User> | Today we did another drill.                 |
| SP>      | Do you feel good about it now?              |
| 2. User> | I feel bad.                                 |
| SP>      | Do you feel the same as you felt yesterday? |
| 3. User> | I have had a terrible day today             |
| SP>      | That’s sad to hear. What happened?          |

**Figure 2.** Conversation examples with Synthetic Partner.

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