Towards Expressive Communication in Embodied Conversational Agents

Michelle Denise Leonhardt[1,2], Sylvie Pesty[2] & Rosa Vicari[1]
[1] Universidade Federal do Rio Grande do Sul (UFGRS), Porto Alegre, Brasil
[2] Laboratoire d'Informatique de Grenoble (LIG), Grenoble, France
{mdleonhardt,rosa}@inf.ufrgs.com; sylvie.pesty@imag.fr

INTRODUCTION

Embodied Conversational Agents (also known as ECA) are animated software agents (usually very similar to the human figure) which represent the possibility of extending the aim of common conversation systems and perform non appropriate verbal behavior, such as facial expressions, looks, gestures and processing of natural language in all its levels, contributing to a better understanding of a message. Bickmore (2003) defines such agents as entities which use, in real time, speech, gestures, observation (among other verbal and non-verbal channels) to simulate face to face human interaction.

Over the last few years, many researchers have worked with ECAs and its related issues, focusing on several aspects of their development (Cassel, 2000; Massaro *et al.*, 2000; Poggi *et al.*, 2005). Moreover, literature can be found exploring the use of language in agents, particularly in ECAs (Jurafsky & Martin, 2000). Because of the importance of nonverbal issues, ECAs must also be conversational in their behaviors, and specifically human like in the way they use their bodies in conversation.

Affective Computing (AC) deals with the use of emotions in modeling intelligent systems and has its origins in studies regarding the role of emotion and its fields with the largest scope, affection, in cognitive activities, especially learning (Izard, 1984). The importance of emotions in human intelligence is evident. Boehner *et al.* (2007) present a discussion about how emotions are made and measured, including views of different factors that influence emotions.

AC techniques have been employed and investigated in order to feel people's affection through a large variety of psychological aspects, verbal and non-verbal channels (Scherer, 1981; Kapoor & Picard, 2002), and to develop systems which demonstrate affection by making use of a variety of types, including speech, facial expressions, among others. (Cahn, 1990; Pelachaud, Badler & Steedman, 1996). Some researchers have also worked on the development of emotions in Embodied Conversational Agents through different modalities of communication (Beskow, Elenius & McGlashan, 1997; Lester *et al.*, 1997, 2000; Ball & Breese, 2000). Others have studied the influence of ECAs in users (Brave, Nass & Hutchinson, 2005). One example of the last is the work of Rosis *et al.* (2005) discussing the ability of ECAs to induce empathy in users.

THE PROPOSED AGENT

The role of our agent is to guide its own construction, as well as participate on it. We are developing a scenario where two participants must collaborate in order to define not only physical characteristics of the ECA, but also emotional ones (based on personality behaviors).

Initially, the role of the ECA is limited to guide the participants in construction aspects. As far as the conversation goes and participants start to decide on aspects of the agent personality, the agent will go deep in conversation, reacting according to its characteristics (by means of language expression and other multimodalities of communication - *i.e.* - if participants decide the agent will have soft personality, the conversation will be conducted accordingly). The idea behind the strong focus on emotion in our agent can be justified by the fact that emotions represent one important modality when communicating a message and latest scientific findings indicate that the use of emotions in Embodied Conversational Agents may contribute to various domains of application. Also, the use of emotions in such agents can contribute to their credibility. Moreover, emotions modulate almost all modes of human communication: facial expression, gestures, posture, among others that play important roles in human-computer interaction.

Emotional display can be a very complex phenomenon involving a wide range of verbal and nonverbal behavior, making the integration between different modalities of communication and textual exchange of messages (together with reasoning mechanisms that can take into consideration the

beliefs and goals of the agent in specific environments) an interesting focus of research. By observing and participating in its own construction, our agent will consider the conditions of success and satisfaction present in each message exchanged. In this context, attitudes can affect their way of speaking and acting.

In order to achieve our goals, our agent will communicate using a set of conversation acts formally defined in order to allow expressive communication between communities of mixed agents (Berger & Pesty, 2005). Mixed communities are those where agents and humans interact together. The idea behind the language is to allow expressive communication between not only software agents but also human agents. This language takes into consideration aspects such expectations, conditions of success, among other characteristics that are present in human communication. The conditions of success and satisfaction are explicitly defined as well as the elements from the conversational background. The possibility of verifying the success and satisfaction conditions of illocutionary acts is essential for conversational agents mainly because one cannot perform adequately an illocutionary act if these conditions are not present.

CONCLUSION

The use of an expressive conversation language in ECAs allows more expressivity in dialogue - empowering, facilitating, and enriching interaction between humans and machines. Although some improve is still necessary in order to engage humans fully (and that include better use of emotions), ECA simulation can be considered a cost-effective means of assessing and improving a broad range of technical and social competencies and skills.

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