

Emotional Dialogs with an Embodied Agent

Addolorata Cavalluzzi, Berardina De Carolis, Valeria Carofiglio, and
Giuseppe Grassano

Intelligent Interfaces, Department of Informatics,
University of Bari, Italy

{cavalluzzi, carofiglio, decarolis, grassano}@di.uniba.it
<http://aos2.di.uniba.it:8080/IntInt.html>

Abstract. We discuss how simulating emotional dialogs with an Embodied Agent requires endowing it with ability to manifest appropriately emotions but also to exploit them in controlling behavior. We then describe a domain-independent testbed to simulate dialogs in affective domains and verify how they change when the context in which interaction occurs is varied. Emotion activation is simulated by dynamic belief networks while dialog simulation is implemented within a logical framework.

1 Introduction

We aim at implementing an Embodied Conversational Agent (ECA) that interacts with the user to provide advice in a domain that is influenced by affective factors. To behave believably, our agent should show some form of emotional intelligence, which requires the ability to *recognize and express emotions* (in self and in the hearer), *regulate them* and *utilize them to optimize the advice provided* [11]. In a first phase of our research, we focused work on emotion expression. To establish when the agent should express an emotion, which emotion and with which intensity, we developed an emotion modeling method and prototype [2]. To make the agent's mind independent of its body, we defined a XML markup language (APML) in which the *meanings* that the agent should show when uttering a sentence are specified as tags [3]. This enabled us to produce, from a discourse plan, an input to agents with different bodies: the agent could manifest emotions in addition to other *meanings* (performative types, belief relations etc), through an appropriate combination of speech and nonverbal *signals* that depended on its body.

The ability to exhibit an emotional state is, however, only a shallow form of the emotional intelligence an agent can show. Emotions have to be utilized to drive reasoning behind the dialog. This implies studying how the dialog may be affected by the emotional state of the two interlocutors and by their personalities. Again according to Picard, emotions influence learning, decision making and memory. If intelligently handled, they may help to manage information overload, regulate prioritization of activities and help in making the decision process more flexible, creative and intelligent. More in general, they motivate and bias behavior, although they do not completely determine it. Simulating affective dialogs therefore requires investigating the following problem issues:

- which emotions arise in the agent during the dialog, as a consequence of exogenous factors (the user move);
- which personality factors affect emotion activation;
- how emotions influence the dialog course: priority of communicative goals, dialog plan, surface realization of communicative acts.

Reaction to emotions and, more in general, their effect on the agent behavior are influenced by the social relationship with the interlocutor. Three types of relationships are envisaged, again by Picard. In situations of *friendship*, the agent tends to have *similarly valenced* emotions in response to the emotions of the interlocutor while, in situations of *animosity*, emotions with *opposite valences* are felt and shown. In situations of *empathy*, the agent temporarily substitutes the presumed goals, standards and preferences of the interlocutor for its own. Of course, empathy and animosity do not tend to go together, but empathy does not necessarily come with friendship, for instance when the agent adopts the interlocutor’s goals, standards and preferences for mere convenience. We wish to go beyond the idea of simulating, in the agent, emotions that mirror or contrast those displayed by the user, to represent the cognitive bases of emotion feeling and their influence on the dialog dynamics: in this paper, we describe the results we have achieved so far.

2 A Model of Emotion Activation

In our emotion modeling method, we pay particular attention to how emotions change of intensity with time, how they mix up and how each of them prevails, in a given situation, according to the agent’s personality and to the social context in which the dialog occurs. So far, we focused our attention on event-driven emotions in Ortony, Clore and Collin’s (*OCC*) theory [10]. In this theory, *positive* emotions (happy-for, hope, joy, etc.) are activated by *desirable* events while *negative* emotions (sorry-for, fear, distress, etc.) arise after *undesirable* events. Events concerning the agent are in the *Well-being* category (joy, distress), events concerning other people are in the *FortuneOfOthers* category (happy-for, sorry-for, envy and gloating) while future events are in the *Prospective* category (fear, hope). In Oatley and Johnson-Laird’s theory, positive and negative emotions are activated (respectively) by the belief that some goal will be achieved or will be threatened [9]. A cognitive model of emotions¹ that is built on this theory should represent the system of beliefs and goal behind emotion activation and endows the agent with the ability to *guess the reason why she feels a particular emotion and to justify it*. It includes the ingredients that enable representing *how the Agent’s system of goals is revised* when emotions are felt and how this revision influences planning of subsequent dialog moves.

Our model of emotion activation is represented with a Dynamic Belief Network (*DBN*). As proposed by Nicholson and Brady [8], we use *DBNs* as a

¹ "We use the term cognitive to refer to psychological explanations in terms of their representation and transformation of knowledge *which may or may not be conscious*" [9]