

Enhancing Embodied Intelligent Agents with Affective User Modelling

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Abstract. The objective of this research is the exploration how affective knowledge used in global controlling mechanisms for public information systems with lifelike presentation agents will increase the effectiveness of such systems in terms of information presentation, but also help the user to better explain his/her needs by adopting a more natural conversational style through interactive dialogue.

1. Background

Conventional public information systems are static in nature, forcing a user to navigate his/her way through a series of multiple-choice options before the required information is obtained. Despite the fact that the information is then well presented, the acceptance level of these systems remains quite low [7].

Recent research has shown that the acceptance level can be significantly improved if a lifelike presentation agent is utilised as a conversational dialogue partner in much the same way as a real human would act [3]. Unfortunately, these systems have so far only been able to create believability through a carefully choreographed presentation of hand-coded dialogue scripts. This approach is obviously very labour intensive, and the breadth of the lifelike character's persona can quickly become exhausted after very few interactions. Unlike chat bots, information systems are primarily geared to impart information, and so cannot simply rely on the "Eliza" effect of making the user feel good about him/herself.

The main challenge of this work will be the combination of the different approaches in dialogue modelling and information presentation. This Ph.D. work uses results and methods from the following research areas: user stereotypes, inference techniques of affective user modelling, adaptive natural language systems, and human-human communication strategies (e.g. sales strategies).

2. Goals

This research will address the problem of user fatigue by explicitly modelling both the user's, and lifelike character's, personality and affective state, and then using these dynamic components to guide the conversational dialogue. This process will be achieved by the following iterative steps:

- Adaptation of communication strategies for the use in the affective presentation and dialogue planning mechanisms.
- Development of an affective reasoning component for the dynamic modelling of the user's and agent's affective model with the required inference methods. The reasoning process appraises events, actions, and objects in the light of the user's and the agent's goals, standards and attitudes. The result will be used to: a) provide a more natural conversation style, and b) provide affective feedback by expressing the emotional state in its gestures and utterances, allowing the agent to adapt better to the needs of the user.
- Evaluation of the effectiveness of affective user/agent models and explicit dialogue strategies in achieving the research objective of increasing information acceptance. The results from these trials will be used to improve the communication strategies and affective model.

3. Issues and Status

This Ph.D. thesis integrates work done in the area of user modelling with research on affective reasoning. In particular, I will enhance a user modelling component with affective information on stereotypes. This knowledge will be used by an affective reasoner component, which includes a reactive primary input appraisal component [6] and a hierarchical presentation planning mechanism [1], [2]. Especially this knowledge will be used to control the selection of dialogue and presentation strategies.

The basic flow of information within this system starts with the analysis of the user's verbal input by the speech component. The speech component attempts to map the input to a specific speech act, and also identify the emotional value. Currently this is done by spotting emotionally loaded words and phrases. Both, speech act and emotional value will be directly appraised with respect to the agent's emotional status. This might then trigger a reactive behaviour, which is immediately shown by the agent. In parallel the agent's deliberative behaviour will be shaped. The affective user-model component is the first step in this process line. It is used to draw inferences from the user's input in relation to specific affective stereotypes. The result will be a goal objective according to the current user's affective state. Based on the user's goal and the system's goal, the affective state of the system will be computed. This has a direct effect on the output strategy selection and on the generation of the following presentation. The affective state of the system is also reflected in the gestures the agent uses and affective speech output.

The building of a complete “affective” lifelike presentation agent system is well beyond the resources of a single Ph.D. research project. Fortunately, I am able to adapt a number of components from projects within the DFKI for my purposes. The EU-funded SAFIRA project, in which a toolkit for supporting affective interactions for real-time applications will be developed, gives me the possibility to implement the affective speech generation software component.

Currently, the following modules are implemented:

- A template based speech interpreter (combined with a primary input appraisal) with a rudimentary dialogue history support. This module is further developed in the SMARTKOM project.
- An Affective Reasoner, based on the Five-Factor model for personality and the Ortony, Clore and Collins (OCC) model for emotions [4], [5].
- The presentation-planning component, based on the PREPLAN engine [1].
- An output rendering module for translating the output of the planning process to commands for the presentation agent, the browser, and the speech output engine.
- A user interface applet, which controls the presentation agent engine and the speech input and output facilities. Currently, the instructions for the rendering components do not yet contain any detailed affective information.

In addition, we have collected information about the first example domain, in which the agent plays the role of a virtual receptionist. Currently visitors can obtain information about people working in the DFKI. In the future, it will answer questions on wider range of dialogue topics covering news, projects, and people within the DFKI.

4. References

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