How Are You ? Synthetic Personalities for Edutainment.

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Abstract

A Virtual Learning Environment (VLE) was introduced in schools in Leeds to help overcome educational and underlying social problems. Studies revealed that the VLE ‘note-taking’ functionality was inadequate so a user-centred design of an Animated Pedagogical Agent was undertaken. This led to the development of a hybrid reactive/deliberative agent-based prototype to help motivate and engage students through the use of appropriate behaviour-based affective qualities. Subsequent evaluation in schools showed that students perceived the intended agent affect. Furthermore, a correlation was also observed between student achievement and student affective perceptions. It is therefore claimed that future agents could adapt affectively partly based upon prior and subsequent student achievement.

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1. Preamble

The question “How are you ?” is commonly used to elicit a description of an interlocutor’s well-being prior to engaging in conversation. It suggests a degree of empathy, curiosity and personable nature of the enquirer. Synthetic personalities, in the domain of Education, aiming to provide such qualities without utilising underlying affective cognitive models are described herein.

2. Background

Research was undertaken in conjunction with Chapeltown and Harehills Assisted Learning Computer School (CHALCS) and other local Leeds schools. CHALCS is an out-of-hours school established in 1987 to directly address educational and corresponding social problems in a deprived inner-city area of Leeds. The project involved the introduction of a Virtual Learning Environment (VLE) for Advanced Level Physics (Barker and Pilkington, 2000).

As the VLE was used with students the tool integral to WebCT (the off-the-shelf VLE) was thought by students, teachers and observers to be unsupportive of the process of student’s summarisation as well as offering few facilities and utilising uninspiring Human-Computer Interaction techniques.

One further motivating factor for the research was the notion of Social Learning Systems proposed by Chan (1996) which are “environments where multiple participants, either computer simulations or real human agents, work at the same computer or across connected machines”. It is a student-centred model which sees the student at the centre of a range of learning supports. However of concern here is an essential part of a Social Learning System, namely the “virtual” or artificial Learning Companion.

3. Supporting Student’s Note-Taking

Studies were undertaken at CHALCS and a ‘feeder’ school, Notre Dame Sixth Form College, in order to ascertain qualities of an improved ‘take notes’ facility. This resulted in recommendations such as a ‘scratch pad’ for jotting ideas and a process model describing the stages which students typically negotiate when note taking (Barker and Pilkington, 2000). A new tool was therefore envisaged which would provide an artificial Learning Companion (Chan and Baskin 1988) with which students could collaborate on the task of note-taking. Previous research in the field of Learning Companions includes that of Aimeur and Frasson (1996), Chan and Baskin (1988, 1990), Goodman et al. (1998), Dillenbourg and Self (1992), Uresti (2000) and Brna et al. (2001). This research is novel in the context of these
efforts in attempting to supplement a commercial VLE with an artificial Learning Companion. It was further hypothesised, based on previous research (Lester et al., 1997), that in order to further engage students in the new process of interactive note-taking the Learning Companion should be based upon work in Animated Pedagogical Agents (Johnson and Rickel, 2000) which would help motivate students and therefore serve as a form of Edutainment.

4. The Philosophy of Affectations

Consequently an Agent was designed in a user-centred approach utilising the Wizard-of-Oz (WoZ) technique (Barker and Pilkington, 2001). Central to the design of the proposed two agents and to the thesis of this research is a notion of seven ‘affectations’ (Barker and Pilkington, 2001) of distinct personality types (‘dominant’ and ‘passive’) utilising “emergent emotions” to ascribe intended ‘feelings’ as hopefully perceived by students. Picard (1997) describes “emergent emotions” as “those which are attributed to systems based on their observed emotional behaviour – especially when the system which is behaving has no explicit internal mechanism or representation for emotions”.

Table 1. Example ‘moves’ for Genie.

<table>
<thead>
<tr>
<th>Moves</th>
<th>Animations</th>
<th>Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>me take over</td>
<td>move to centre of screen, cloud magically appears (+ cymbal noise), rubs hands together, raises eyebrows, returns to original position</td>
<td>“I’m going next!”</td>
</tr>
<tr>
<td>you wrong!</td>
<td>hands out, shake head, scratch head, hands shoot out, mouth open aghast</td>
<td>“you could have done better!”</td>
</tr>
<tr>
<td>why?</td>
<td>hands shoot out to sides, mouth open aghast, one hand on hip, other on side of face with eyebrows raised</td>
<td>“tell me why you did that!”</td>
</tr>
<tr>
<td>yes</td>
<td>raised eyebrows, smile, clutching hands</td>
<td>“yes, definitely!”</td>
</tr>
<tr>
<td>no</td>
<td>hands out to side and shake head</td>
<td>“no way!”</td>
</tr>
</tbody>
</table>
| well done   | move to centre of screen, applaud then return to original position | “Clever you!”
|             |                                                 | “Well done!”            |

A Genie was prototyped for the WoZ study to demonstrate the ‘dominant’ affectations. Table 1 shows some of it’s final ‘moves’ including the animation sequences and corresponding speech acts. However, these are a refined version of those utilised in the WoZ study as they were redesigned based upon results of the study.

5. Implementing an Artificial Learning Companion

Barker and Pilkington (2001) describe the architecture of the Summary Intelligent Learning Assistant (SILA). This description includes accounts of the conceptual units of SILA such as the environment (i.e. WebCT and summary), the sensors, the reactive layer (containing the dialogue model), deliberative layers (e.g. to condense phrases), the world model (containing the summary representation) and the actuators. In addition to development using Visual BASIC and Microsoft Agent (also described therein) Microsoft Agent Scripting Helper (MASH) was utilised to aid authoring of the kinds of animations and speech utterances shown in Table 1. Microsoft Agent was chosen for speed of development in the prototype SILA (ProSILA) as it provides all the necessary core services to quickly implement an Animated Agent, such as fundamental animation sequences, a Text-To-Speech engine, voice recognition and an API for Visual BASIC.

Figure 1 shows the Genie making a contribution in the SILA environment, pointing towards the new addition and telling the student to “look at this!”. It can be seen that the top window in Figure 1 shows the WebCT Physics course in a web browser and the bottom window shows the current notes. Between the two windows can be seen formatting tools and information then at the very top of the SILA window can be seen menu commands, for example, to provide file and browser functionality, assistant selection (the ‘dominant’ Genie or ‘passive’ Peedy the Parrot) and help.

The student, then, interacts with the two agents by right mouse clicking over them (or speaking) to select context-sensitive commands. This results in the dialogue model advancing to the next state which may necessitate an action by either the student or the agent, such as the addition of a phrase in the summary document. This interaction continues until either party is satisfied that adequate notes have been produced.
6. Evaluating SILA

SILA was evaluated with students utilising a ‘cooperative evaluation’ methodology (Dix et al., 1997). The computer screen was videoed and one pre and one post semi-structured interview carried out. Also, a log of interactions and expert’s summary scores were obtained. Subsequent analysis of the data employed both quantitative and qualitative techniques. This resulted in an interesting emerging correlation of perceived agent affect and student achievement, see Figure 2, suggesting a relationship between the two measures. That is, high achievers and low achievers perceive less positive affect whilst average students perceive most positive affect.

In addition student’s self-reports indicated a difference in perception of affect between the two assistants. Peedy was seen as portraying more positive affect along the seven employed affectations than that of Genie thus demonstrating a successful design. Furthermore a number of suggestions for further work emerged from these evaluations such as having the assistants display differing behaviours for the same ‘moves’ and improving the explanation facility so that any phrase in the student notes could be elaborated upon by SILA and not just the most recent addition.

7. Preliminary Conclusions

The correlation of affect and achievement leads to a possibility of future agents partly adapting affectively to students on the basis of their performance, for instance in summarisation, or potentially in other cognitive tasks. For example, for students who perform well at summarisation the agents may act more ‘dominantly’ and for those who perform less effectively then the agents could act more ‘submissively’. That is, ‘dominant’ agents will use terse language and be hasty whereas ‘passive’ agents would be more polite and more patient. Additionally, the agents can be seen to be displaying some of the “empathic characteristics” as elucidated by Brna et al. (2001) and validated in the evaluations although they have no underlying model of affect. Therefore one conclusion is that a valid cognitive model of an artificial Agent’s internal ‘emotional’ state is not necessarily a precursor to creating valid emotional couplings between student and Learning Companion. This is in-keeping with results found by Reeves and Nass (1996). That is, personality is conveyed to subjects through such simple means as appropriate language and simple animation without resorting to ‘traditional’ AI techniques.

8. Future Research Directions

Current research (Kapoor et al., 2001) is exploring Learning Companions which recognise student’s affective states across mixed modalities thus circumventing reliance on error-prone student self-reporting (e.g. Abou-Jaude, 1999). This would allow an agent to assess the student’s affective state which, together with other information such as summarisation achievement, would result in the agent adapting its reasoning and affective behaviour accordingly. These effective affective responses to student states need not be ‘traditional’ cognitive-like models but situated state-based automata as currently utilised in SILA’s dialogue model although more ‘traditional’ AI techniques could still be employed in the more deliberative cognitive tasks such as summarisation. This hybrid deliberative and
reactive approach with its combination of emotional and behavioural ‘intelligence’ in the Agent would lead to a more holistic approach to the aim of creating socially meaningful student-agent interactions in-keeping with current ideas concerning human cognitive abilities emerging from, for example, Neuroscience (Damasio, 1994). Unfortunately, for now, the question “How are you?” is practically going unasked. However, it seems like future research may well be in a position to begin to furnish an answer leading to exciting possibilities, particularly in **Synthetic Personalities for Edutainment**.

**References**


