Animated Agents for Language Conversation Training

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Abstract: Animated agents are cartoon-style characters that facilitate the learning process. We take an animated agent approach to improve English conversation skills of Japanese students. In particular, we use animated agents as conversational partners in interactive role-playing environments (theater, drama, and games). In order to engage the language student, animated agents feature believability-enhancing behaviors such emotional responses and social competence.

Motivation

Recent years show a growing interest in animated agents to enhance learning in computer-based interactive learning environments (Johnson et al. 2000). Lester and colleagues (1999) promote *animated pedagogical agents* for their motivational role in the learning context, in addition to the possibility of increased learning effectiveness. In this empirical study, they show the affective impact of animated agents on students' learning experiences, that revealed the so-called *persona effect*: "[...] which is that the presence of a lifelike character in an interactive learning environment […] can have a strong positive effect on student's perception of their learning experience."

Encouraged by those results, we recently started a project with the aim to employ animated characters for the pedagogical task of language training. Specifically, the animated agent approach will be used to improve English conversation skills of native speakers of Japanese. Serving a similar purpose, *Native World* (Oki Software), a commercial software tool, allows users to practice English by interacting with native English speakers displayed in video clips. Instead of preparing video clips for all possible dialogue moves, we believe that animated characters give more flexibility without sacrificing pedagogical effectiveness. Moreover, we envision client-side execution in a web browser as the learning environment.

In a typical conversation-training situation, the user interacts with one or more characters, and plays the role, e.g., of a customer in a virtual interactive coffee shop. The programmable interface of the Microsoft agent package is used to control and display the characters involved in the conversation. The animated characters available for this package are endowed with a variety of behaviors ('animations'), speech recognition, and a text-to-speech engine. To keep the students motivated, strong emphasis is put on the *believability* of the animated characters, by giving them rudimentary personalities, emotion expression, and social role awareness.

The next section describes our language conversation training system. We will introduce two kinds of agents, AIs and scripted non-player characters. After that, we conclude the paper.

Affective Agents as Conversational Partners

So far, we implemented three role-playing scenarios. In our interactive theater, the user may take the role of Rosencrantz, the companion of Guildenstern in Tom Stoppard's famous play. Our interactive drama offers the role of a customer in a virtual coffee shop. In line with the popularity of computer games, we also developed an interactive role-playing game, the *Wumpus World*. When first starting a session, the Microsoft Agent library is automatically downloaded, the only requirement is to run Microsoft's Internet Explorer 5.0 or newer.

Similar to game developers, we distinguish between AIs and scripted non-player characters. AIs are autonomous agents that serve as dramatically interesting conversational partners for the user. Scripted non-player characters, on the other hand, are scripted agents that simply run predefined scripts.

Autonomous Agents

It is widely accepted that animated characters with believable emotional and social behavior are an important contribution to make learning environments more enjoyable and fun for users. Hence, each character involved in a role-playing interaction with the user has its own mental model, and is able to reason about its affective state and the social context.

An agent's mental model contains different kinds of entities, including world knowledge (beliefs), affective states (emotions, moods, personality traits), and goals. Our *affective reasoner* derives from the influential 'cognitive appraisal for emotions' model of Ortony, Clore, and Collins, also known as the OCC model (Ortony et al. 1988). Here, emotions are seen as valenced reactions to events, other agents' actions, and objects, qualified by the agent's goals, standards, and preferences. The OCC model groups emotion types according to cognitive eliciting conditions. In total, twenty-two classes of eliciting conditions are identified and labeled by a word or phrase, such as 'joy', 'fears-confirmed', or 'angry-at'. Emotional states, however, cannot be directly mapped to emotion expressing behavior, as emotional responses largely depend on an agent's personality and the social context in which the conversation is embedded. Thus, we place so-called *social filter programs* at the interface of the module that reasons about emotion (the affective reasoner) and the module that renders the emotional state to actual behavior. Basically, a social filter program consists of a set of rules that encode qualifying conditions for emotion expression. Emotions are then expressed in accordance with the vocal effects associated with Ekman's 'basic emotions'. E.g., if a character expresses the emotion 'happiness', its speech is typically faster, higher-pitched, and slightly louder. In effect, we achieve that characters react reasonably when interacting with the user, which makes them believable and even compelling conversational partners.

Prolog programs implement all reasoning related to conversation management and agents' mental models, i.e., affective and social reasoning. Jinni 2000 (BinNet Corp.) is used to communicate between Prolog code and the Java objects that control the agents through JavaScript code.

Scripted Agents

Some agents are not directly involved in the interaction with the user. Typically, those characters are used as 'background' characters, e.g., as visitors in a coffee shop whose conversation the language student can listen to. Scripted non-player characters possess all features of the AI characters (e.g., emotion expression) except for the reasoning component. Although conceptually easier than autonomous agents, it turned out to be very time consuming to control them with JavaScript. E.g., consider a dialogue between two characters that fulfills communicative functions related to initiation/termination of the conversation, turn-taking, and back-channel feedback. Even for a short episode, a prohibitively large number of 'requests' have to be set due to the inherently parallel nature of a conversation, e.g., one character is nodding while the other character is speaking.

Hence, we use an XML-style markup language called MPML that supports easy scripting of characters and easy integration of other media components (Ishizuka et al. 2000). MPML (Multi-modal Presentation Markup Language) was originally developed for the purpose of creating animated web-based presentations.

Conclusion

In general, we believe that animated agents offer enormous promise for interactive learning environments. Despite the early stage of animated agent research, it seems likely that this new generation of learning technologies will have a significant impact on web-based education and training. Although speech output sounds somewhat artificial and language understanding is highly restricted, animated agents behave in surprisingly lifelike ways. However, there is still a long way to go to make animated characters truly social and conversational. Also, we have to gain a better understanding of exactly which features make animated agents engaging as conversational partners or pedagogically effective as virtual tutors. We envision the animated agent approach as a new paradigm in computer-assisted (language) learning, and continuously strive to make this vision come true.

References

Ishizuka, M., Tsutsui, T., Saeyor, S., Dohi, H., Zong, Y., and Prendinger, H. MPML: A multimodal presentation markup language with character control functions. *Proceedings of Agents'2000 Workshop on Achieving Human-like Behavior in Interactive Animated Agents*, 2000, 50-54.

Johnson, W.L., Rickel, J.W., and Lester, J.C. Animated pedagogical agents: Face-to-face interaction in interactive learning environments. *International Journal of Artificial Intelligence in Education*. 2000.

Lester, J.C., Converse, S.A., Stone, B.A., and Kahler, S.E. Animated pedagogical agents and problem-solving effectiveness: A large-scale empirical evaluation. *Artificial Intelligence in Education*, IOS Press: Amsterdam, 1999, 23-30.

Ortony, A., Clore, G.L., and Collins, A. *The Cognitive Structure of Emotions*. Cambridge University Press, 1988.