

Carrying the Role-Playing Metaphor to Interactive Learning Environments

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ABSTRACT

We motivate the role-playing metaphor for intelligent educational interfaces in two ways: first, as an enjoyable interaction style between users and animated agents, and secondly - taken more literally - we argue that the concept of social role should be considered in the design of agents' mental models. In particular, we introduce social control programs that qualify the agent's expression of its affective state by the social context. We also describe a web-based language learning system that uses animated agents as conversational partners in role-playing environments.

Keywords

Social dimension in communication, role playing, affective reasoning and expression, believable animated agents

INTRODUCTION

We recently started a project with the aim to employ animated agents for the pedagogical task of language conversation training. Specifically, the animated agent approach [1] will be used to improve English conversation skills of native speakers of Japanese. We opted to employ a general conversation model [2] that covers different kinds of user-agent and inter-agent communication, which we call *role-playing* interactions. In a typical conversation training situation, the user interacts with one or more agent characters, and plays the role, e.g., of a customer in a virtual interactive coffee shop. Our notion of role-playing interaction emphasizes the *social level* of communication. At this level, agents respect interpersonal relationships and modify their behavior according to their social role. In particular, the agent's social role determines its way of emotion expression. In our system, social reasoning is blended with a rather standard theory of reasoning about emotion [4]. We use Moulin's [2] approach to model and simulate conversations, which provides a rich framework

for many aspects of inter-agent communication. We believe that considering the social dimension in role-playing interactions adds value to intelligent (pedagogical) interfaces for the following reasons:

- It enhances the believability of animated agents, which is often captured by emotion and personality only.
- It explains the frequent mismatch between the output of affective reasoning (the emotional state) and emotion expression, as seen in human-human communication.

MENTAL MODELS OF AGENTS

Each agent is assumed to have a mental model. A mental model may contain different kinds of entities, including world knowledge (beliefs), affective states (emotions, moods, personality traits), goals and plans. We will concentrate on reasoning about affective states and reasoning about the social context.

Reasoning about Emotion vs. Emotion Expression

Emotional behavior is an important contribution to make the interface more effective and enjoyable for users. Emotion can be conveyed through various channels, such as facial display (expression), speech and body movement. A 'basic emotions' approach distills those emotions that have *distinctive* expressions associated with them. Murray and Arnott [3] describe the vocal effects on five basic emotions: fear, anger, sadness, happiness, and disgust. E.g., for the emotion 'happiness', speech is typically faster, higher-pitched, and slightly louder.

Reasoning about emotion is equally important for animated agents. Many systems that reason about emotion, so-called *affective reasoners*, derive from the influential 'cognitive appraisal for emotions' model of Ortony, Clore, and Collins, also known as the OCC model (see, e.g., [4]). Here, emotions are seen as valenced reactions to events, agents' actions, and objects, qualified by the agents' 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', or 'angry-at'. Consider you ask your boss to give you some

vacation and your boss turns you down. You are now angry at your boss because you cannot do the trip you were looking for. How will you react to your boss? Presumably you will nod, showing that you understood your boss' answer, and try to convince her or him that you really need some days off, in a calm voice with a rather neutral facial expression.

Your behavior – suppressing the expression of your emotional state – can be explained in at least two ways. First, you might have *personality traits* that characterize you as friendly and introverted. Second, and probably more important in this scenario, you might be aware of your *social role* as an employee which puts restrictions on your response to your boss (reflecting communicative conventions applicable to this socio-organizational setting).

Social Filter Programs

A social filter program consists of a set of rules that encode qualifying conditions for emotion expression. This control program acts as a filter between the agent's affective state and its rendering in a social context, such as a conversation. We consider the agent's personality and the agent's social role as the most important emotion expression qualifying conditions. Currently, only two dimensions of personality are taken into account, extraversion and agreeableness.

Social roles are ordered according to a power scale, which defines the social power of an agent's role over other roles, and imposes certain conventional practices (behavioral constraints and communicative conventions) on the agents' behavior [2]. If the conversational partner has more social power, emotion expression is typically 'neutralized'. If an agent communicates with an agent whose role is equal or lower, personality traits come into effect.

ROLE-PLAYING IN AN INTERACTIVE ENVIRONMENT

Our interactive learning environment for English conversation training for Japanese speakers assumes that users would enjoy getting involved in a role-play with agents, and thereby overcome their uneasiness to converse in a foreign language. Our *interactive drama* offers the role of a customer in a virtual coffee shop (see Fig. 1).

To run our example conversations, we use the programmable interface of the Microsoft Agent package, which provides controls to embed animated characters into a web page based JavaScript interface, and includes a voice recognizer and a text-to-speech engine. Jinni 2000 (BinNet Corp.) is used to communicate between Prolog code (for affective/social reasoning) and the Java objects that control the agents though JavaScript code. The user can promote the development of the conversation by uttering one of a set of predefined sentences. The character will respond by synthetic speech, facial display, and gestures. The parameters for speech output are set in accordance with the vocal effects associated with five basic emotions [3].

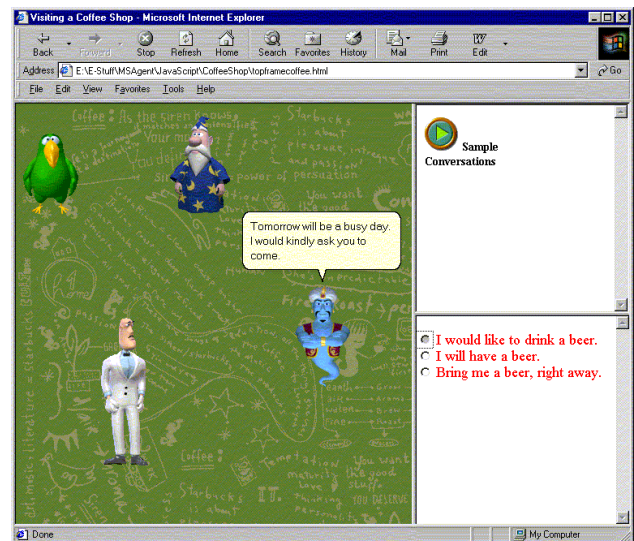


Fig. 1: Sample conversation with waiter agent 'James', manager agent 'Genie' and two customer agents.

The following is an annotated trace of a run of our conversation system. Here, the user interacts with a waiter-style character (extrovert, unfriendly) as a customer, who himself interacts with a manager-style character (neutral, friendly) as an employee.

Customer: I would like to drink a beer. [User can select linguistic style (polite, neutral, or rude).]

Waiter (to customer): No way, this is a coffee shop. Get out of here! [Considers it as blameworthy to be asked for alcohol and shows his anger.]

Waiter (to manager): Good afternoon, boss. May I take a day off tomorrow? [Performs welcome gesture.]

Manager: Tomorrow will be a busy day. I would kindly ask you to come. [Uses polite linguistic style.]

Waiter: Ok, I will be there. [Waiter is aware of his lower social role and therefore does not show his anger. Instead, he shows neutral emotion expression.]

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