Context Awareness in Mobile Relational Agents

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1 Introduction

The development of virtual agents designed to draw users into personal and professional relationships with them represents a growing area of research [1]. Mobility and context awareness represent important directions of research for these relational agents, since they offer unique affordances for relationship development. A mobile/wearable agent has the potential to be with a user for a significant period of time, and frequency of contact alone has been shown to be associated with increased solidarity between people. The ability to sense some aspects of the user's environment (context awareness) may also provide mobile agents with unique relational affordances. Automatically recognizing and commenting on situations in the user's life can amplify many relational perceptions, including familiarity, common ground, solidarity and intimacy. In addition, an agent's ability to proactively interrupt and help a user in a situation that is automatically sensed by the agent may lead to increased perceptions of trust and caring by the user.

2 Experimental Platform

We have developed a general purpose relational agent interface for use on handheld computers such as PDAs (Fig. 1). The animated agent appears in a fixed close-up shot, and is capable of a range of nonverbal conversational behavior, including: facial displays of emotion; head nods; eye gaze movement; eyebrow raises; posture shifts and visemes. These behaviors are synchronized in real time with agent output utterances, which are displayed in a text balloon rather than using speech, for privacy reasons. User inputs are constrained to multiple choice selections at the bottom of the display.

Fig 1. Mobile Virtual Agent Interface

Interaction dialogues are scripted in an XML-based hierarchical state-transition network, which allows for the rapid development and modification of system behavior. Scripts consist primarily of agent utterances, the allowed user responses to each agent utterance, and instructions for state transitions based on these responses and other system events (timers, sensor input, etc.). Scripts are authored using a visual design tool, and are then processed using the BEAT text-to-embodied-speech engine [2], which automatically adds specifications for agent nonverbal behavior. In addition, visemes are generated using an extension of the *freeTTS* text-to-speech engine.

Interruption behavior can be very flexibly defined using a variety of wait states and state transitions conditioned on events. During specified wait states, the PDA's display shuts off, and the interface remains dormant until some condition is met, while sensor inputs and other background processes remain active. Example wake up conditions include specific times of day, changes in user behavior as measured by sensor input, or hardware key presses by the user.

The initial application domain for the handheld agent is exercise promotion using an integrated 2D accelerometer enabling the agent to tell whether a user is currently walking at a moderate intensity or not (based on a speed calibrated for each user).

3 Pilot Study on Awareness and Social Bonding

In order to explore the relational efficacy of context awareness, we conducted a small study to compare a mobile context aware agent with an otherwise identical agent without sensing ability. Both agents attempted to motivate users to walk more, but in one condition (AWARE) the agent could sense whether the user was walking at moderate intensity or not and automatically provided feedback to the user whenever they finished a walk, while in the other condition (NON-AWARE) the user had to explicitly tell the agent when they were starting and ending a walk. The study was a counter-balanced within-subjects design experiment in which each treatment lasted four days. Eight males, aged 19-23, participated in the study.

Results indicated that context awareness led to greater user-agent bonding ($F(1,4,)=8.6$, $p<.05$), but less walking (minutes of moderate intensity walking, $F(1,4)=74.3$, $p<.001$) in study participants. This difference in walking behavior may have been due to perceptions of low reliability in the sensing mechanism, or to the psychological effect of making a commitment to the NON-AWARE agent when walk starts were declared. Ongoing work will address these issues in future versions.

Acknowledgements. This work was supported by NIH National Library of Medicine grant R21LM008553.

References

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