

Robotic and Virtual Companions for Isolated Older Adults

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Introduction

The goal of the Always-On project¹ is to create a relational agent that will provide social support to reduce the isolation of healthy, but isolated older adults. The agent is “always on,” i.e. it is continuously available and aware (using a camera and infrared motion sensor) when the user is in its presence and can initiate interaction with the user, rather than requiring the user login to begin interaction.

We expect that the agent will help reduce the user’s isolation not just by always being around but also by specific activities that connect the user with friends, family and the local community. Our goal is for the agent to be a natural, human-like presence that “resides” in the user’s apartment. Beginning in the late summer of 2014, we will be placing our agents with users for a month-long evaluation study.

Three issues of our project directly concern the topics of this workshop are: (1) the embodiment of the agent, (2) the engagement behaviors that are associated with being “always on,” and (3) AI tools for support intelligent behavior.

Embodiment

We are experimenting with two forms of agent embodiment. Our main study (with 20 users) will employ the virtual agent Karen, shown in Figure 1, that comes from the work of Bickmore et al. (Bickmore et al. 2005). Karen is a human-like agent animated from a cartoon-shaded 3D model. She is shown in Figure 1 playing a social game of cards with user. Notice that user input is via a touch-screen menu using an ASUS touch screen computer. Also, the speech bubble does not appear in the actual interface, which uses text-to-speech generation.

We are also planning an exploratory study (with 8 users) substituting the Reeti² robot, shown in Figure 2, for Karen, but otherwise keeping the rest of the system (i.e., the menus, text-to-speech, looking and gazing,) the same. Among the



Figure 1: Virtual agent interface — “Karen”

measures we will be using are questionnaires that assess the elder’s happiness, loneliness, health status, social support and alliance with the virtual agent. These measures are all ones we hope to influence in a positive direction.

One big difference we expect to occur in users’ behavior results from the use of face tracking with our two agents. Our previous experience with robots indicates that face tracking is a very noticeable effect with people. While we do not have any experience yet with users interacting with virtual agents that track the user’s face, our own personal experience indicates that this is not a particularly strong effect. Thus it may be the case that users who “live” with our robot Reeti will be much more aware of its presence, which may generate additional effects in terms of desiring interaction, paying attention to Reeti or being afraid of it. On the other hand, because Reeti is not as human-like as Karen, it is possible that it will not be as well accepted overall as Karen.

By comparing people’s responses to these two embodiments in situ, we will learn more about the nature of people’s behavior with virtual versus robotic agents when they interact for an extended period of time. Due to the longevity of the interaction as well as the richness of activities (some

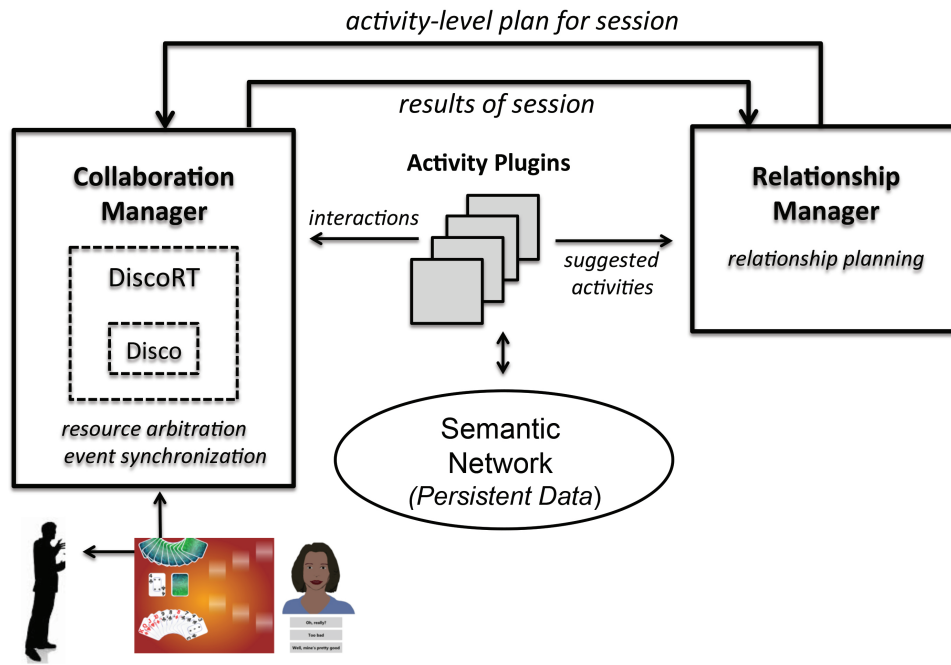


Figure 3: Always-On system architecture

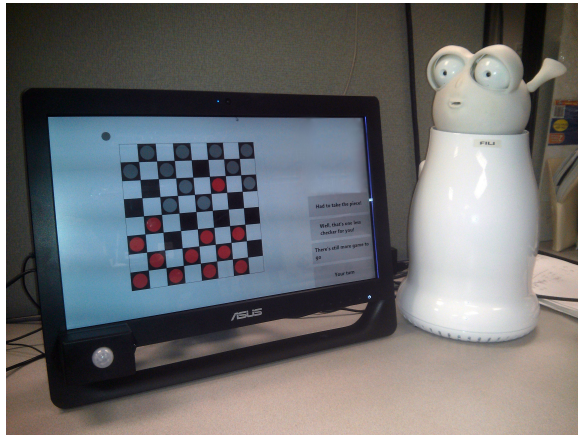


Figure 2: Robotic interface — “Reeti”

purely conversational and some task-based), we hope that users in both conditions will have extensive dialogue interactions, find those interactions satisfying, and develop a strong working relationship with their companion, in whichever embodiment. Part of our month long study will be to assess these experiences and determine if differences do occur.

One take-away of our preliminary studies (Vardoulakis et al. 2012) is that users would like to have more activities to do with the agent. For example, they wanted to be able to tell the agent about their friends and family. Different activities can serve different goals, either improving the user’s well-being by reducing social isolation, or just doing something the user wants to do. Activities such as talking about

the weather or playing a social game of cards or checkers are meant as ice breakers. Other activities are more instrumental, such as the agent’s self-introduction dialogs, or the user’s enrollment dialogs, in which he/she provides information about family members, such as their relationship, geographic location, and birthday. Given knowledge of the user’s family and friends, our agent supports the user’s desire to talk about them, albeit in a very limited fashion, and offers to make video calls to them. The agent can tell short humorous anecdotes to the user, and also offer nutrition and health tips.

Engagement behaviors

Engagement behaviors contribute to the awareness of interaction between the user and the agent. Our system continuously maintains a model of the state of engagement (Sidner et al. 2005) between the user and the agent. For example, when the agent senses nearby motion (via infrared) followed by the appearance of a face in its vision system, it decides that the user is initiating engagement. Disengagement can come about at the natural conclusion of the conversation or when the user leaves for an unexpected reason, e.g., to answer a ringing door bell. Because our agent cannot understand sounds in the environment, it may not know why the user has disengaged, but it does have simple strategies for dealing with unexpected interruptions. Generally, the agent does not initiate disengagement, although it interrupts ongoing activities and reminds the user of an upcoming event that is listed in the user’s calendar.

AI tools to support intelligent behavior

Figure 3 shows the high-level architecture of our system, called DiscoRT (Disco for Real-Time) (Nooraei, Rich, and Sidner 2014), to the collaborative dialogue system Disco (Rich and Sidner 2012). which addresses three main challenges. The first challenge is modularity and extensibility with respect to activities and the second is extensive dialogue interaction. Third, real-time behavior is essential for sensing by our agent and its ability to respond in real-time to the user for engagement and time-sensitive events. In addition, we use a simple AI planner to determine what to do in each session. A semantic network, using the OWL ontology, captures knowledge about the elder over the course of conversations—for example, the names and other info about elder’s friends, events that have been put in the calendar, or reports of walking exercise. It also captures knowledge about the world (e.g. that birthdays occur once a year) that are used by various activities.

The entire system is implemented in a combination of Java and .NET on WindowsTM.

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