To appear in 14th Annual SIGdial Meeting on Discourse and Dialogue, Metz, France, August 2013.

Demonstration of an Always-On Companion for Isolated Older Adults

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Abstract

We summarize the status of an ongoing project to develop and evaluate a companion for isolated older adults. Four key scientific issues in the project are: embodiment, interaction paradigm, engagement and relationship. The system architecture is extensible and handles real-time behaviors. The system supports multiple activities, including discussing the weather, playing cards, telling stories, exercise coaching and video conferencing. A live, working demo system will be presented at the meeting.

1 Introduction

The Always-On project[1] is a four-year effort, currently in its third year, supported by the U.S. National Science Foundation at Worcester Polytechnic Institute and Northeastern University. The goal of the project 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," which is to say that 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, for example requiring the user login to begin interaction. Our goal is for the agent to be a natural, human-like presence that "resides" in the user's dwelling for an extended period of time. Beginning in the fall of 2013, we will be placing our agents with about a number of users for a month-long, 4 arm, evaluation/comparison study.

[1] http://www.cs.wpi.edu/~rich/always

Figure 1: Virtual agent interface — "Karen"

Our project focuses on four key scientific issues:

- the embodiment of the agent,
- the interaction paradigm,
- the engagement between the user and the agent, and
- the nature of the social relationship between the user and the agent.

1.1 Embodiment

We are experimenting with two forms of agent embodiment. Our main study 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. Also, the speech bubble does not appear in the actual interface, which uses text-to-speech generation.

We are also planning an exploratory study substituting the Reeti[2] robot, shown in Figure 2, for Karen, but otherwise keeping the rest of the system (i.e., the menus, text-to-speech and other screen graphics) as much the same as possible. One big difference we expect is that the effect of face tracking with the robotic agent will be much stronger than with Karen. 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.

1.2 Interaction Paradigm

The main interaction paradigm in our system is conversation, and in particular, dialog. The agent makes its contributions to the dialog using speech, and the user chooses his/her contribution from a menu of utterances provided on the touch screen. Dialogs evolve around various activities and can extend for quite a long time (up to five or ten minutes) if the user chooses to continue the conversation. Dialog models can be created using whatever system that the system designer chooses. In our work, we use models that are scripting formats, a Java state machine model based on adjacency pairs or created with the dialog tool Disco (Rich and Sidner, 2012). This variety of models makes our system more flexible for system designers.

The agent is not designed to accept speech input for several reasons:

- lack of voice models for older adults;
- no reliable means to circumscribe the collection of utterances that the system could understand;
- the wide range of activities to talk about with the agent results in a huge number of utterance structures, semantic structures and possible intentions. We doubt there are existing speech-to-utterance semantics systems available to support such a plethora of choices with high reliability. As our project is *not* about spoken language understanding, we opted not to take on this burden.

Some of the activities between user and agent involve additional on-screen graphics, such as the card game shown in Figure 1, or a Week-At-A-Glance™ style planning calendar. When playing cards together, the user is allowed to directly manipulate the cards on-screen. For the calendar, the user may only do deictic gestures. All other information is handled through dialog. We have thus eschewed other traditional GUI methods using icons, pull-down lists, etc., in favor of using speech and menu dialog interaction whenever possible. The other exception, like direct manipulation of cards on-screen, is a virtual keyboard to allow typing in of proper names of people and places. Our motivation for this design choice is to reinforce the relationship between the user and the agent, and to simplify the interaction in comparison to standard GUIs.

[2] http://www.reeti.fr

1.3 Engagement


Figure 2: Robotic interface — "Reeti"

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 may attempt to hurry the conclusion of a session if some event in the user's calendar is about to start.

Since the user and agent have conversations over an extended period of time, it is natural to consider that they have some kind of social relationship (Bickmore and Schulman, 2012; Kidd and Breazeal, 2007). To reason about this relationship, we have implemented a planning system (Coon et al., 2013) that decides which activities are appropriate to suggest to the user each time they interact (in what we call a *session*). This planning system uses a relationship model based on the *closeness* between the agent and user. Their closeness increases as they do activities together. Closeness decreases when the user and agent do not interact for a period of time, such as a few days.

Each available activity has a *required* closeness in order to be undertaken. Only those activities whose required closeness is less than or equal to the current closeness between the user and agent will be suggested for the current session. Activities that, although suggested, do not actually occur (due to user choice or other reasons) are reported to the relationship planning system for planning the next session.

2 Activities for User and Agent

We will demonstrate our operational system with a several of the activities that the user and agent can do together. In total, we will have more than ten different activities including: discuss the weather, learn about the activities to do with the agent, play a social game of cards, talk about family/friends, tell a life story to the agent, promote exercise, promote nutrition, hear a humorous tale from the agent, get health tips from the agent, speak with a friend/family member via Skype™ (with all the details of SKYPE managed by the agent), and manage a personal calendar for the user.

A typical interaction with the agent might start with some greetings (specific to the time of day) and then some discussion of the weather. The weather discussion can be as short as today's weather forecast or extend to the next day, weather in other cities, and weather where friends or family live. At the user's choice, weather might be followed by a social game of cards where the agent's and user's hands in the game and the way the game is played out are commented upon. If the user and agent are somewhat well acquainted, thereafter might follow discussion of the user's family and friends. For each person that agent has learned about, the agent might ask:

Figure 3 shows an excerpt from a menu-based interaction in our currently running system. Following ths discussion of family and friends the user might opt to end the conversation or continue with other activities such as the calendaring system, hearing some health tips from the agent, and so on.

Agent: So how is Mary doing?
- I don't want to talk about her today.
- I'm done talking about my family and friends.
- Overall pretty good.
- Not so great. ⇐*User*

Agent: Oh, what's wrong?
- She is ill.
- She had an accident.
- She lost a family member. ⇐*User*
- She is pretty lonely.
- She is postponing a visit to me.

Agent: That's very sad.

Figure 3: Example menu-based interaction.

Acknowledgments

This work is supported in part by the National Science Foundation under award IIS-1012083. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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