She has been a leader in demonstrating the success of "active learning"—that is, allowing robots to ask their users for help when input is needed. For example, when straightening up a room, the robot might ask the user to match labels such as "book" or "magazine" to objects it sees in the room, thus expanding its library for object recognition. To select what features to consider, the robot could ask if factors such as color or size are relevant to the task at hand.

A Virtual Home Companion

What changes when an intelligent virtual agent is in your home and on, continuously, for months at a time? To start with, you will expect it to interact differently with you on the day it arrives, when it is still a stranger, than on the 10th day, when it has become an acquaintance, and on the 30th day, when it may be transforming into a true companion.

With a four-year, $1.8 million award from the National Science Foundation, Candace Sidner, research professor of computer science, is attempting to answer this question in the context of older adults who live alone. Working with Charles Rich, professor of computer science at WPI, and Timothy Bickmore, head of the Relational Agents Group at Northeastern University, Sidner is developing a virtual agent that can provide social support and promote healthy behaviors. "We want this technology to broaden people's lives," she says. "Our aim is to increase human contact, not to replace it."

The virtual agent, named Karen, appears as an animated face on a touchscreen computer. Using computer vision and infrared motion detection, Karen can notice when someone walks into the room or approaches her and then strike up a conversation using a computer-generated voice. Her human host can talk to her by selecting items from a menu on the touchscreen.

These conversations can range from simple chit-chat about the weather, to friendly banter while playing a social game of cards, to more serious discussions about exercise

Dealing Cards…and a Little Friendly Advice

In her role as companion, the virtual agent Karen can emulate the very human skill of using simple chit-chat as a vehicle for transitioning to more serious conversations. In this example, she brings up exercise while playing rummy. Karen's words are spoken; the human responds by making selections on a touchscreen.

I've got terrible cards!

Me too

I've got great cards

Just play!

Good Move! Here's mine.

Not too bad

Give me a minute

Let's stop after this round

By the way, I have been thinking about a walkingbuddy for you.

What's that?

I don't want to talk about it right now

A walking buddy is someone you go walking with regularly. It's more fun than walking alone.

Sounds complicated

How do I get one?

Let's just play cards

Candace Sidner and Charles Rich are developing technology that will permit a computer agent like Karen to be a long-term virtual companion to an elderly person, keeping their calendar, helping them stay in touch with family, and encouraging then to exercise and eat right.

and diet. Karen can also remind her host about appointments, set up Skype visits with friends and relatives, and carry out other useful tasks. Her behaviors are guided by a computer model that predicts when each activity is most appropriate given the time of day, what has happened so far in the current conversation, and the overall status of the relationship.

"Karen is much more than a simple stimulus-response system," Rich says. "She has long-term goals for the relationship and a memory of past activities, and she can plan for the future."

This project builds upon on a long history of research on artificial intelligence and human-computer interaction by Sidner, Rich, and Bickmore. Karen's developers have been gaining real-world experience with the current prototype over the past year through field studies that have put some of her capabilities to the test in the homes of isolated older adults in Boston. In the year ahead, Karen will spend up to six weeks in 20 homes in the project's first long-term study.

The virtual agent technology behind Karen could also be deployed in robots designed to serve as home companions. In fact, the final phase of this research will involve giving Karen a three-dimensional human-like head in a field test that will investigate whether people respond differently to a physically embodied agent than to a virtual one.

"All the software developed through this work," Sidner says, "will be freely available to help other researchers realize the goal of making virtual agents and robots part of the family."