CHERITON SCHOOL OF COMPUTER SCIENCE

ACT@Home: An emotionally intelligent cognitive assistant to help people with Alzheimer's disease

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A common early symptom of Alzheimer's disease is difficulty remembering recent events, but as the disease progresses it affects an increasingly larger sphere of a person's life.

"People think of Alzheimer's as a condition that impairs short-term memory. It does, but as the disease progresses it also causes problems with more distant memories, reasoning and behaviour, and impairs a person's ability to complete activities of daily living independently," said Professor Jesse Hoey, computer scientist who has combined research interests in artificial intelligence with mathematical models of human interaction.

"People with Alzheimer's disease may start to wash their hands, then forget what they're doing, why they're doing it, lose motivation, forget what they've done so far and repeat steps, or just stop partway through," Hoey said. "Their care partner — often the person they live with — usually steps in to help, but the amount of assistance required can become overwhelming. We've developed an assistive technology to help older adults with Alzheimer's disease complete activities of daily living more independently by giving automated prompts based on the observed situation."

Known as ACT@Home, the system Hoey and his students have developed goes further than just providing cues and prompts. The team has developed a prototype emotionally intelligent assistant that interprets the dynamics of human interaction and then responds accordingly.

"We realized after years of designing artificially intelligent systems that we can solve the technical problems of an automated prompting system — using sensors to detect in the home what a person with Alzheimer's is doing, processing the information and responding with a verbal or visual cue," he explained. "But convincing a person with Alzheimer's disease to do something is much more difficult, and that depends on the person's interpretation of the situation — what they think is going on, what they perceive is happening, what cues they're getting — and, importantly, who they think they are."

As its name implies, ACT@Home is an automated assistance technology that combines artificial intelligence with mathematical models of affect control theory or ACT, a sociological framework that proposes people conduct themselves in a way as to generate feelings that are appropriate to the situation or context, Hoey explained.

"Say, that I'm an elderly man with Alzheimer's disease. My interaction with others is based on my feelings of who I am and who I think others are. I will interact differently with a friend than I will with my spouse or a doctor. Humans adjust their interactions based on who the other person is or, more precisely, who the other person feels like. We all engage in this little theatrical performance," he explained.

The interesting discovery is that this performance is not lost completely in people with Alzheimer's disease. And that's where Hoey's automated assistant comes in.

Alzheimer's disease heavily disrupts a person's comprehension of the way the world works — for example, whether to take pill A or pill B before bedtime, or to dry one's hands after they've been washed. But a person with Alzheimer's still remembers what it feels like to interact with others, he explained.

"That's where the rubber hits the road — it's not just when but how you prompt a person. ACT@Home works by building a model of what's going on in the mind of someone with Alzheimer's disease when they are prompted to do something," he explained.

Hoey and his collaborators have been conducting qualitative interviews of people with Alzheimer's and their caregivers to better understand what it means to be a person with the disease and how they interact with others.

"Our goal is to take the findings from these interviews to develop an inexpensive home-based emotionally intelligent cognitive assistant that helps people with Alzheimer's disease while lightening the burden on their caregivers."