Improving Engagement Through Emotional Alignment

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Abstract
Emotional alignment is a key factor in human interactions. This is no less true for persons for dementia, and recent work shows that it may be a critical element for this population. Computational models of emotions can be used to provide guidance to caregivers, automated assistants, and researchers when interacting with persons with dementia. In this paper we describe our work in studying and building these computational models, and how they can be used to promote engagement with research, caregiving, and assistance.

Author Keywords
Dementia; human-centered Design; affective computing; engagement

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction and Background
People with cognitive disabilities such as dementia and Alzheimer's disease face challenges for completing daily tasks. Cognitive assistive technologies aim to help them achieve an increased level of independence. These technologies also help the caregivers and reduce the feelings of dependence in people with such disabilities.

To design and develop a successful assistive system, several complications and uncertainties should be addressed. This requires multidisciplinary collaboration of teams of researchers and inclusion of people with dementia in the design and development processes. The artificially intelligent components of the system should function properly in the real world and under uncertainty. The user interface needs to be designed in a way that facilitates human's interaction with the system and several aspects of user-centered design should be taken into account. Most importantly, the technology should be accepted by people. For such systems to be accepted, an affective connection is required between people and the system, and the technology should be capable of being personalized for different users and in different stages of dementia.

Previous and On-going Research

Several technologies have been and are being developed to decrease dependence of people with dementia and Alzheimer's disease on caregivers [1]. ACT@HOME and COACH are examples of such technologies. COACH [3, 10] is a prompting system that assists older adults with dementia through hand-washing. The system reminds people of their situation and prompts subsequent tasks, leading to increased independence especially in more private tasks such as using the washroom. ACT@HOME is an intelligent cognitive assistant based on the COACH that will be programmed to learn affective identity of people during an interaction, to personalize the prompts based on their needs [8, 6].

Ultimately, a system that allows end-users to personalize prompts in a do-it-yourself (D.I.Y.) approach would be highly valuable for caregivers and healthcare professionals. Such technology increases involvement of people in design and enables them to better express their preferences and needs. The goal of the D.I.Y. Smart Home project is to develop such user-centered technology [2, 4, 11].

Further, the affective connection between these systems and people is required to increase acceptability of the system [9, 5]. This connection helps develop systems that can be better adapted by people who have different personalities and are in different stages of dementia. To this end, we study how emotions and facial expressions of virtual humans are perceived by different people [9, 7], to develop virtual assistants that are emotionally aligned with the people with cognitive disabilities and are capable of generating user-specific prompts.

Engaging with Research

This research would greatly benefit from the inclusion of people living with dementia in the design process, as their engagement is crucial to learn about their preferences, needs, and different personalities. Such interaction will also help with exploring future design possibilities, as well as better adjusting the existing systems to deliver the desirable outcome. Given that the ultimate goal of our research is to improve the quality of life of those with dementia, an opportunity have the most important stakeholders directly involved in the research will help us expand our research to meet their needs at different levels of their daily lives (e.g. doing personal tasks at home, their interactions in the community, at work, etc.). Such interaction also facilitates identification and prioritization of their needs.

Engagement of people with dementia in research depends on their emotional state and sense of self. The sense of self emerges from a lifetime of experiences, which form an enduring self-sentiment rooted in affective or emotional meanings. Self-sentiments govern emotions and behavior and persist even in the face of cognitive decline [5]. Therefore,

people with Alzheimer's disease (AD) retain a psychological sense of self. This sense of self may be key to quality of life. While effective care providers discern a person's emotional state intuitively and interact on that basis, ineffective or inexperienced care providers, artificially intelligent assistance systems, and inexperienced researchers (e.g. from fields outside of rehabilitation science) may have more difficulty and may cause psychological distress.

To address this issue and to better understand individual's sense of self and emotions, we are developing a social simulator based on a novel model of human emotional alignment called Bayesian Affect Control Theory (BayesACT). BayesACT is a rigorous socio-cultural theory of affective interactions between individuals which is built upon more than 25 years of development in the sociological and psychological literature, and has been developed to work as the reasoning engine for artificially intelligent (AI) agents. BayesACT uses a sequential Monte-Carlo estimation method to predict human actions in social situations. The social simulator to be built will provide an end-user interface to this model, and will be validated as a tool used by caregivers of older adults with dementia and researchers attempting to engage with older adults with dementia. The social simulator will provide valuable insights to the caregivers, assistance systems, and researchers about how to interact with people with Alzheimer's in a way that they feel emotionally aligned and motivated to improve their engagement.

Author Biographies

Moojan Ghafurian is a Postdoctoral Fellow in the David R. Cheriton School of Computer Science at the University of Waterloo. Her research areas are Human-Computer Interaction, Cognitive Science, and Artificial Intelligence. She has published at Designing Interactive Systems (DIS), International Conference on Cognitive Modeling (ICCM), and Annual Conferences of the Cognitive Science Society (CogSci). She has received the NSF grant to attend the Summer School on Cognitive Robotics at MIT, and travel awards to attend Human Computer Interaction Consortium (HCIC 2017) and the CRA-W Grad Cohort Workshop. She has also received scholarships to attend GHC 2014 and GHC 2017, and has participated at the ACM GH 2016 Student Research Competition (SRC). She is currently applying her skills in the development of intelligent assistive technologies and tutoring systems that help people with cognitive disabilities.

Jesse Hoey is an associate professor in the David R. Cheriton School of Computer Science at the University of Waterloo, where he leads the Computational Health Informatics Laboratory (CHIL). He is also an adjunct scientist at the Toronto Rehabilitation Institute in Toronto, Canada, where he is co-leader of the AI and Robotics Research Team. He works on problems in computational social science, probabilistic and decision theoretic automated reasoning, affective computing, rehabilitation science, and ubiquitous computing. Much of his work has focused on developing systems to help persons with a cognitive disability (e.g. Alzheimer's disease) to engage in activities of daily living. He was the program chair for the 10th EAI International Conference on Pervasive Computing Technologies for Healthcare, and the chair of the Alzheimer's Association International Society to Advance Alzheimer's Research and Treatment (ISTAART) Technology Professional Interest Area (TPIA). He is a Network Investigator for the AGEWELL Network of Centers of Excellence.

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