

# Design of a device to assist with repetitive questions in patients with Alzheimer's Disease

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## *Abstract*

Technology may be able to play a role in improving the quality of life for Alzheimer's patients and their caregivers. However, Alzheimer's patients suffer from cognitive and physical limitations that will impair their ability to use standard interface techniques. We are designing an information appliance with the goal of alleviating the repetitive questioning behaviour, a contributing factor to caregiver stress.

*Key words:* Assistive technology, information appliance, cognitive aging, Alzheimer's Disease.

## 1 Introduction

Through the design of an information appliance to help alleviate the repetitive questioning behaviour of Alzheimer's Disease (AD) patients, we are investigating the role that technology may play in improving the quality of life for AD patients and their caregivers. At question are whether or not patients and caregivers will be willing to use technology, the barriers to use of technology for this population, and the effectiveness of technology at relieving some of the caregiver stress associated with the repetitive questioning behaviour. This is part of an interdisciplinary study with investigators from medicine, computer science, and industrial design.

## 2 Background

### 2.1 Repetitive Questioning Behaviour

One of the behavioural symptoms of dementia is repetitive questioning whereby a person with dementia asks the same question over and over again of their caregiver. Reasons for this behaviour can include short-term memory loss and lack of recall, boredom, feelings of insecurity or anxiety about their ability to cope, and anxiety about future events. [1]

Repetitive questioning is a troubling behaviour for caregivers. Amnesic behaviours have been reported to be the most common spontaneous complaint by the family members of Alzheimer's patients [1]. Current guidelines provided for caregivers for coping with this behaviour include writing the answer down and later

directing the patient to the written answer; having the patient find the answer for themselves; and providing reorientation for the patient with written reminders, signs, clocks, calendars, and whiteboards as well as through familiar objects and memories [2].

### 2.2 Characteristics of Alzheimer's Patients

Alzheimer's patients have several characteristics that impair their ability to use standard user interface techniques. These include cognitive impairment, declining language abilities and normal effects of aging.

There is a wide range in the level of cognitive impairment of AD patients [2]. Mild stage patients have difficulty handling complex tasks that require sequencing of actions and have problems with recent memory, but respond well to prompting. Moderate stage patients need help with the basic activities of daily living.

Alzheimer's patients also exhibit declining language abilities [2]. Mild stage patients may occasionally stammer, substitute words that are similar in meaning, and describe functions of items when they can't recall the name of the item. Moderate phase patients exhibit incomplete sentence structure, have increased difficulty in naming objects, and substitute syllables within words. Reading comprehension is impaired before auditory comprehension.

Additionally, most Alzheimer's patients are elderly and thus have the normal limitations on their vision and hearing associated with aging. Hand tremors may limit their input abilities with keyboards, mice, and styli, while speech input can be limited by voice tremors and short-term memory limitations.

## 3 Related Work

There are several research initiatives [3] investigating ways of providing technological support for our aging population, from ubiquitous systems such as smart homes to assistive robotics. While some of the systems primarily monitor the elderly for safety purposes, cognitive orthotic systems provide aids for those with reduced cognitive abilities due to injury or disease.

One example of technological support for Alzheimer's patients is the Assisted Cognition Project [4] that is developing the Activity Compass to reduce spatial disorientation and the ADL Prompter that assists with the completion of activities of daily living (ADLs).

Many of these systems are designed to assist the patient without requiring them to initiate the interactions. As an example, the ADL prompter [4] monitors the patient as they complete ADLs and only prompts them when they become stalled. However, patients do interact with their caregivers throughout the day and may be capable of initiating some interactions with technology.

#### 4 Hypothesis

Our hypothesis is that an information appliance that provides information in an accessible manner to AD patients can help decrease caregiver stress caused by repetitive questioning by allowing the AD patient to access the desired information on their own. Provided that the patient is willing to initiate interactions with the appliance or be guided to it, this application of technology may offer the patient some satisfaction in not having to primarily depend on the caregiver for their information needs. While the reasons behind repetitive questioning are varied, this research will focus on the problem of the AD patient not remembering information due to problems with recall.

The term information appliance implies a computerized device that is communication-oriented and specialized to serve a well-defined purpose in a manner that is easy to use. The reduced functionality of an information appliance should result in a reduction in complexity [5]. In our case, the specialized purpose of the device will be to provide information in an accessible manner to Alzheimer's patients with cognitive limitations on their interaction capabilities. The precise requirements of the information appliance under design, including its functionality, degree of mobility, interaction techniques, and choice of technologies, will be determined during a user and needs analysis with AD patients and their caregivers.

As the onus will be on the caregiver to ensure that the information desired by the patient is available on the device, any solution must also provide caregivers with a quick and easy method to update the information on the device. Due to the large degree of individual variability between patients, it is assumed that personalization of the technology to meet the individual patterns of repetitive questioning and interaction capabilities of the patient will help achieve this goal. This assumption

will be examined during the initial information-gathering phase of the research.

#### 5 Future Work

A qualitative approach will be undertaken to explore the dimensions of repetitive questioning in an effort to provide a user and needs analysis for a technological intervention for the problem. The data gathered will provide information about the general parameters of the behaviour and the individual aspects of it that may influence the design of human-computer interactions.

In the first phase of the research, semi-structured interviews will be conducted with AD patients (12 mild phase and 12 medium phase) and their caregivers. Caregivers will also complete daily diaries over the course of a week to record the details of the repetitive questioning behaviour. In Phase 2, paper prototypes of interface designs and three-dimensional mockups of information appliances will be shown to the patients and caregivers for feedback. In the third phase, one design will be implemented and subsequently evaluated through interviews, daily diaries, and activity data to determine its suitability and effectiveness.

Preliminary results from the first phase of the research will be available by the conference date for inclusion on the poster presentation.

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