

# **MAPS: PDA SCAFFOLDING FOR INDEPENDENCE FOR PERSONS WITH COGNITIVE IMPAIRMENTS**

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**ABSTRACT:** Individuals with cognitive disabilities are often unable to live on their own because of deficiencies in memory, attention, and executive functionalities. Computationally enhanced prompting systems can provide a necessary bridge to independent living. High levels of assistive technology abandonment are driven, in part, by poor user interfaces for the configuration of these devices. MAPS (**M**emory **A**iding **P**rompting **S**ystem) provides a simple effective prompting system with an interface for caregivers designed to effect high rates of integration into daily life.

## **BACKGROUND**

Cognitively impaired individuals are often unable to live on their own because of deficiencies in memory, attention, and executive functionalities. These deficits can create inability to consistently perform normal domestic tasks like cooking, taking medications, performing personal hygiene and taking public transportation. Prompting systems consist of breaking down a task into constituent parts and creating prompts, consisting of pairs of images and verbal instructions, for each step. A prompting script is a set of prompts that make up a task. A common way of transitioning from assisted living (or living with ones family) to independent or semi-independent living is thru the use of prompting systems. In the U.S. alone, there are approximately 20 million persons, or 7%, of the U.S. general population, who are afflicted with cognitive disabilities costing over \$100 billion per year in maintenance, long term care, and lost productivity (1).

## **STATEMENT OF PROBLEM**

Device rejection is the fate of a large percentage of purchased Assistive technology (2). Users (caregivers) report difficulties in configuring and modifying configurations in assistive technology that often lead to abandonment (3). Some experts estimate that as much as 75% of all such devices and systems are purchased and not used over the long run (4). By viewing the configuration and other caregiver tasks as a separate and equally important interface, and applying techniques such as task-oriented design (5), this abandonment problem could be mitigated.

The target population for MAPS would be cognitively disabled individuals. Using standard notation (6) this would be “trainable Mentally Handicapped’ IQ 55-72 and the upper range of ‘Severely Mentally Handicapped’ IQ >55. There are two other target populations that the device’s interface needs to be designed for: the installer (often a trained assistive technologist) and the caregiver (often a family member) who would eventually re-configure the system. These users need an intuitive interface that is scaled to their level of skills with computers. They will be assumed to be able to compose a letter on a word processor but not much more.

There is a small body of literature concerning the design and implementation issues for assistive technology and augmentative and alternative communication devices, including Thomas King (2) for general AT design guidelines and Beukelman (7) for issues specific to augmentative and alternative communication device implementation. The proceedings of the ASSETS conferences (8) and several journals (9) (10) (11) have been useful.

Prompting by independent living transition professionals with and without cards is an established technique used for both learning and performing a task by cognitively impaired adults and older children. Prompting studies provide a background for design and study of computationally based prompting systems - there have been several papers on the topic of computerized prompting and individuals with cognitive impairments by a European research group (12) (13) and several others (14).

Existing computer based prompting tools provide more information to base design and theoretical inferences. Of special interest is the Visions System (15), a stationary prompting and scheduling system based on PC's using speakers and stationary touch screens to prompt thru complex domestic tasks like cooking; sets of cards assist away-from-the-system tasks like grocery shopping. Existing PDA based systems include the Able Link team (16) with a product called 'Pocket Coach' that gives a series of vocal prompts running on a PDA using WinCE, the Swedish Isaac project (17), which did much initial exploration of PDA's for cognitively disabled, and the PEAT (18) systems are of interest.

## **DESIGN RATIONALE**

The initial parameters and basis of the project are a result of a research-based process for determining system requirements in the context of studies of various types of cognitively challenged individuals.

The device chosen as a platform for the project needs to:

- display an image of high enough quality to be experienced as a 'picture' rather than an icon;
- have sound quality and volume enough for clearly hearing prompts in outdoor environments;
- have affordances 'chunky' enough for not so finely coordinated fingers;

Additional requirements include a simple way to backtrack or start over to allow for mistakes during task completion; in general it should be a very 'forgiving' interface, to reduce anxiety over failure in using it. Beyond the bare minimum of hardware and software the issue of 'look and feel' needs to be addressed. The device should be perceived as 'cool' not 'dorky' or 'handicappy' (2). The other users' requirements need to be properly addressed. The system and its configuration software must be simple enough to get used immediately and deep enough so that many different tasks could be configured. In implementing the creation and saving of scripts for sets of prompts, there could be facilities for a repository of such scripts and this would encourage creation of communities of practice about the users of the palm based prompting system.

## **DESIGN**

MAPS uses a PDA platform to display verbal and pictorial prompts in a sequence that comprise a script. The PDA provides backtracking, restarting and 'panic button' functionality (via wireless connectivity). As a script is played a timer logs the events and provides logging information for script refinement and analysis as well as immediate alternate prompts for breakdown situations. Concrete images are gathered using a built in digital camera.

A PC based application provides tools for script creation, modification and sharing with other users via a web-based repository of scripts. The web repository has a browser based search, storage, and retrieval engine facilitating sharing and building of a body of

successful scripts. There are several levels of logging, from the ability to trace steps not taken on an immediate basis to long term logging for diagnostic analysis. The interfaces for the initial installer and ongoing changes are targeted at non-computer professionals, and are simple and intuitive.

MAPS is a system, consisting of several hardware parts (the PC and the PDA) and several different interfaces (for the user, installer, and reconfigurer) By designing a *System* - including easy to create and modify prompting scripts - small user groups could be connected thru the medium of sharing and modifying scripts in *repositories* of scripts. This could provide an immediate cause for the creation of a forum of users, caregivers and designers that would assist in overcoming the insulated life that these problems often produce.

## EVALUATION

Currently, MAPS is in the early prototyping stage, with a completed PC and PDA application, We have just received acceptance of our experimental protocol from the human research committee of the university. Evaluation is to be done at different stages in the design and with the different target populations. Initially, we will do a basic usability study with the bare idea and both disabled users and experts in the field. Evaluation with the cognitively disabled becomes very difficult in both objective terms and getting help with what the user wants. Usability studies with the installation and configuration population are designed. Finally when the project is complete, I will do some analysis as to the usefulness of the device with respect to the abandonment issue. This will be hard to do in a non-trivial manner. I will probably assemble a team for the design and testing comprising colleagues, experts, family members and, of course, the actual intended users.

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