

MAPS: Dynamic Scaffolding for Independence for Persons with Cognitive Impairments

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Abstract. Individuals with cognitive disabilities are often unable to live independently due to their inability to perform daily tasks. Computationally enhanced dynamic prompting systems can mitigate this inability. Poor user interfaces, however, drive high levels of assistive technology abandonment by this population. To address this issue, MAPS (**M**emory **A**iding **P**rompting **S**ystem) provides an effective prompting system with an intuitive interface for configuration. User modeling techniques facilitate simple and effective prompting scripts for individual user needs.

1 Background

Cognitively impaired individuals are often unable to live on their own due to deficiencies in memory, attention, and executive functionalities. These deficits can result in an inability to consistently perform normal domestic tasks, which then forces these persons to require ongoing support, often in assisted-living homes. A common way of transitioning from assisted living to independent or semi-independent living is through the use of prompting systems. A prompting system is produced by breaking down a task into constituent steps; a set of steps constitute a prompting script. Each step or prompt is made up of a visual and a verbal component. Traditional prompting systems, however, provide only pre-task generated scripts, ignoring changing environments, dynamic situations, and evolving user needs.

Caregivers report that difficulties in producing and modifying configurations in assistive technology often lead to abandonment. Some experts estimate that as much as 75% of all assistive technology devices and systems are abandoned [8].

These deficits in prompting and reasons for abandonment are addressed in the prompting system MAPS (**M**emory **A**iding **P**rompting **S**ystem). The target populations for MAPS are cognitively disabled individuals in the “trainable Mentally Handicapped” (IQ 55-72) range and in the upper range of “Severely Mentally Handicapped” (IQ < 55); as well as their caregivers with basic computer skills.

2 Related Research

Prompting studies provide a background for the design and study of computationally based prompting systems. A small body of literature, including the work of King [7] and Beukelman [3], addresses design and implementation issues for assistive technology and augmentative and alternative communication devices. Existing PC- [2] and PDA- [1] based prompting systems provide information to base design and theoretical inferences.

MAPS provides a mobile prompting platform that provides context-sensitive prompts. MAPS approaches the configuration and script generation tasks as a second user interface, acknowledging the dual user interface requirements in assistive technology design. My research with MAPS is based on several topics from the larger UM (User Modeling) and HCI (Human-Computer Interaction) communities. The design of MAPS context sensitivity, error detection, and error correction functions are informed by various studies of distributed cognition [9]. User modeling studies shape the design of the script editor application and error trapping and correction modules of the MAPS system [4].

3 Design

MAPS comprises a PDA prompter and a PC-based script editor tool. Functional requirements include a simple way to backtrack, or start over, to allow for mistakes during task completion; appropriate wireless connectivity for dynamic, context-based prompt generation; and "panic button" functionality.

The MAPS caregiver interface, a PC-based application, provides tools for script creation, previewing, modification, and sharing via a repository of scripts. The script editor and system configuration software must be simple enough to allow immediate use as well as deep enough to allow many different types of tasks to be scripted. User categorization models [6] provide support for *critic*-style aid in composing scripts, as well as automatic generation of error trapping and appropriate corrective actions.

A MAPS script may have several points at which the timing and content of the next required step depends on the context of the user, the user's capabilities, and the state of the environment. For instance, on a bus trip, the user may need to wait at the bus stop *until* the correct bus arrives, and when the right bus arrives, a prompt must be displayed instructing the user to board *that* bus. By interfacing the MAPS prompter with a server coordinating GPS (Global Positioning System) data from the bus, the running of a typical bus trip script can interact with the real-time events on the streets, prompting the user to wait and proceed when appropriate.

One of the advantages of computationally enhanced prompting systems is the ability to track and repair errors. This dynamic adaptivity affords great gains in useful functionality and reliability, but at a cost in configurational complexity. Because every script is, by design, unique to the user and situation, the number of potential error states and sets of error-trapping flags can become unmanageably big if configured individually. By generating a user model in the MAPS caregiver script editor/creator setup, error situations at typical stages of a given type of script can be

populated by uniform *templates* of correction (which will be then instantiated with the appropriate contextual data). This combined user-needs model (user specifics and generic task/segment error correction template) affords almost automatic error flag pattern trapping as well as appropriate dynamic prompt generation.

4 Open Issues and Next Steps

The full scope of my research, beyond the implementation and evaluation of the prompter and script editor, includes utilizing and evaluating user modeling techniques to create individual “templates” for script design, error detection, and error correction for specific task domains, such as using public transportation or shopping. A rough framework and preliminary design of database schema for user modeling templates, generic script types, and script error type segmentation has been developed.

Implementing and evaluating context-sensitive wireless dynamic prompt generation, such as in the case of a bus delay or missed connection, constitutes the second challenge in my research. Issues of data format standardization and intercommunication need to be addressed and solved due to the designed reliance on, and the tight integration of, the MAPS prompter system and several other CLever projects [5].

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