

Design and Evaluation of Complex Assistive Technology Systems Using Ethnographic Methods

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ABSTRACT

This paper describes the assessment of MAPS (Memory Aiding Prompting System), a system that provides task support prompting to support independence for persons with cognitive disabilities and caregivers. MAPS consists of a handheld prompter and a multimedia editing tool for task script creation, storage, and modification. The need for ethnographic tool use is discussed and a short sub-set of the analysis results is presented.

Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces - User-centered design; K.4.2 [Computers and Society]: Social Issues - Assistive technologies for persons with disabilities

General Terms

Design, Experimentation, Human Factors.

Keywords

Assistive Technology, Ethnographic Methods.

1. INTRODUCTION

Individuals with cognitive impairments are often unable to live on their own because of deficiencies in memory, attention, and executive functionalities [1]. These deficits may lead to an inability to consistently perform typical domestic tasks like cooking, taking medications, and personal hygiene. A common way of transitioning from assisted living to independent or semi-independent living is through the use of prompting techniques. Traditionally, prompting is a method of teaching a person with cognitive disabilities to perform a task through repetition and memorization. [2]. A set of such steps is called a script. Another approach to task support uses artifacts to trigger the correct sequence of behaviors to accomplish the task, thus changing the approach from memorization of the steps to using a prompting device and following its stored sequence of steps. By providing well-fitted scripts, successful task completion might be supported without the cognitive load of memorization. A PDA based

prompter can act as an external trigger cueing internal scripts of the user [3]. Because of the deeply individual needs and abilities of persons with cognitive disabilities, the scripts for task support need to be created and maintained by caregivers who have intimate knowledge of the person with cognitive disabilities, thus making two end-users of the system: the script creator and the script user [4]. Both of the users need well-crafted and tested user interfaces. A pair consisting of a person with cognitive disabilities and caregiver will be referred to as a dyad, and the person with cognitive disabilities as a client.

2. MAPS

My dissertation research has involved studying the process of design and evaluation of high functioning assistive technology (AT), the vehicle I developed for this is MAPS (Memory Aiding Prompting System) [5]. MAPS consists of a handheld computer (the prompter) and a PC based script editor (the editor).

The MAPS script editor enables the user to assemble scripts by selecting image and wav files, represented by the image itself and the file name of the wavefile respectively. The user can then save the script to the underlying database, which provides support for script reuse and modification over time. In the design process caregivers were assumed to have computer skills on the level of being able to compose a letter on a word processor, but no more. The MAPS prompter displays the prompt image and its accompanying verbal instruction. It has a few simple controls: the touch screen is one large button that advances the script forward one prompt, the hardware buttons on the bottom are mapped to backing up and replaying the verbal prompt.

3. Assessment of MAPS in Field Studies

MAPS was tested by four dyads in three groups representing typical use domains: 1) young adults living with their parents while still in school, 2) young adults enrolled in a transition program of their local school system, and 3) adults living in group homes with varying levels of caregiver support. This was studied using ethnographic methods, specifically participant observation and semi-structured interviewing [6] The trial was structured into three sections:

- A. Several visits with the client with and without the caregiver present, designed to gain insight into the general life of the participants. This was about 6 hours of contact for each pair.
- B. A short tutorial in task segmentation and script creation.
- C. Building and testing increasingly complex scripts:

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- a. (Most controlled) Where the environment does not change in the process of doing the task, typically housework.
- b. (Less controlled) Where the parts of the task may change in the process of performing the script and the timing of subtasks is important, typically cooking.
- c. (Most realistic) A task done where both the environment and the task may dynamically change, and often there is interaction with others, typically employment.

Each script represented a real task that the person with cognitive disabilities might encounter in day-to-day life and were done in the real environment that the task would normally be done. The performance of each of these scripts was observed and audio recorded

Ethnographic methods were chosen in order to understand a typical social environment that AT use takes place in, as well as getting *in situ* usability results. The analysis process consisted of transferring field notes and audio recordings to text files and classifying them with codes [7]. Coding the resultant 108-page text with 104 codes resulted in 1,298 instances of coded observations. These were used to develop abstractions about script creation and use as well as about general AT issues.

3.1 Analysis

An attribute of scripts that is not an immediately obvious component to their success or failure is the voice that records the verbal prompts. The voice can confound as well as enhance the task support process. Young adults with cognitive disabilities are not just persons with cognitive disabilities—they are teenagers, and although developmentally delayed, go through all the difficulties that children experience transitioning through adolescence. As a result, when the first script was being designed, the mother suggested that she not be the voice on the prompter. The mom realized that prompting instructions coming from the MAPS-prompter would be entangled with the issues of power and independence that the two of them had been experiencing, so a neutral male voice was provided for the recordings

Several of the dyads put task support markings on the prompter itself. The markings fell into two categories: additions to support general MAPS-prompter navigation and additions to support specific task scripts. Two of the dyads chose to add markings to the front of the MAPS-prompter, above the hardware controls. One dyad glued onto the back of the handheld a complex color scheme required in the employment task, that provided an “overhead view” of the task to be done. For some dyads, every script had some environmental artifact support. For example, one of the family dyads needed the valves and controls marked on the washing machines and on the burners on the stove.

In 75% of the dyads, the scripts were rewritten after initial use. In some cases, the rewriting consisted of replacing pictures; in others, re-recording the prompt instructions. In the group home, the initial script had both pictures and sounds replaced as well as deleting steps that had been learned by the client in the first usages. The same lessons that led to rewriting a script can, over time, lead to re-estimating the granularity of internal scripts, and resizing the following scripts to fit the user’s current ability. This resizing can be referred to as collapsing the task support scaffolding.

Perhaps the biggest initial obstacles to success in using the MAPS system were the caregivers’ task choice, segmentation, and script

design. Three of the four caregivers in this study had problems with task segmentation in the initial script. This manifested in several ways:

- Overestimating internal scripts (too few steps)
- Underestimating internal scripts (too many steps)
- Not encoding tacit knowledge
- Missing or misstated steps

The client skipping forward and not stopping and to cue the next prompt may be caused by underestimating internal scripts, which can also cause the client to experience frustration at the slowness of the process. Overestimating can cause confusion and task failure

4. Conclusion

The use of ethnographic techniques can reveal both problems and potential opportunities in the whole system, consisting of the dyads as well as the environment, tasks and interactions among all three, that usability tests alone may not expose. The process of doing this kind of dynamic assessment is particularly suited to an iterative design approach, giving a voice to all stakeholders.

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