Using electronic memory aids: A comparison of patients and elderly subjects

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Introduction

Learning to handle commercially available electronic memory aids requires a number of cognitive resources. Such devices are useful for the rehabilitation of brain injured patients especially for compensation of prospective memory failures. An alarm reminds the patient to carry out tasks in the future. Memory impaired patients, however, are hardly able to learn how to use them. Wilson et al. (1989) showed, that even six steps of data entry were too much to remember for most of the patients. If released from data entry, however, patients did improve their performance with the help of the devices.

A decrease of prospective memory functioning has also been discussed in the context of aging. Age effects became evident in laboratory, but not in every day life because elderly seem to compensate their deficits by using external aids (Maylor, 1996; Zacks et al., 2000). Only little is known about their ability to learn the handling of electronic aids. Mackowiak et al. (1994) reported that the ease of learning was an important factor for using devices for taking medication. This was why seniors hesitated to use electronic aids even though the effectiveness was rated much higher.

In order to better understand the requirements for and to optimize the user interfaces for both patients and elderly subjects we compared both groups examining the following questions: Are brain injured patients and elderly able to learn dealing with commercially available electronic memory aids? Do electronic memory aids help improving performance on prospective memory tasks?

Method

Subjects: (for subject characteristics see Table1)
- 12 brain injured patients (mostly traumatic brain injury and cerebrovascular diseases) with mildly to moderately impaired memory functions
- 12 healthy elderly

Table 1: Demographic, medical and neuropsychological information

	Patient	Elderly	*p*
Number (N)	12	12	
Sex (male/female)	12/0	6/6	
Age (Mean/Range)	44.0 (28-58)	64.8 (58-75)	<.001
Time post injury (Mean/Range)	49.5 (28-86)	-	
MWT —IQ (Mean/Range)	108 (89-134)	120 (108-134)	<.04
WMS-R —MQ (Mean/Range)	85 (69-118)	113 (93-134)	<.001

Devices:
The organizer Palm m100 and the mobile phone Siemens c35i were chosen. Both devices have a calendar function and remind the user with an alarm of the execution of an appointment.

Procedure:
Palm organizer and mobile phone were compared in an ABAC design. A baseline of two weeks without any electronic aid (Phase A) was followed by a treatment phase of two weeks with one of the devices (Phase B, C). The order was balanced. A break of minimally one week was inserted between the two devices. Training took place during baseline.
Six experimental tasks (see below) had to be fulfilled in each phase. Before the devices were handed over to the patients, all tasks had been entered by the examiner, in order to avoid problems with data entry for the Palm and mobile phone.

Evaluation of the learning process
Training:
- four sessions (maximum) of 60 minutes
- practising of five features relevant for handling each device (entering appointments, retrieving missed appointments, entering repeated appointments, postponing and deleting appointments) depending on the learning progress
- use of simplified operating instruction and a training procedure based on errorless learning

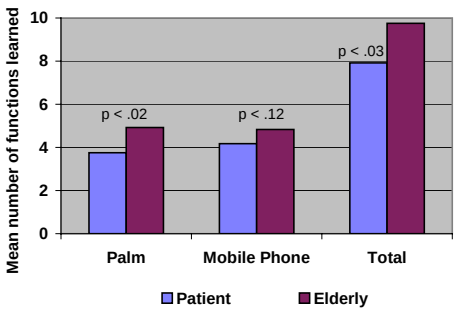
Final test:
- entering of six appointments into the device
- time limit of 45 minutes
- evaluation of performance (with or without support)

Appointments entered during treatment:
- the number of individual intentions entered into the device during treatment phase was taken as an indicator of usability of the device

Benefit of using an electronic memory aid:
- six experimental tasks per phase
  - call a mailbox (twice a week)
  - post a letter with memory diary (one per week)

Results

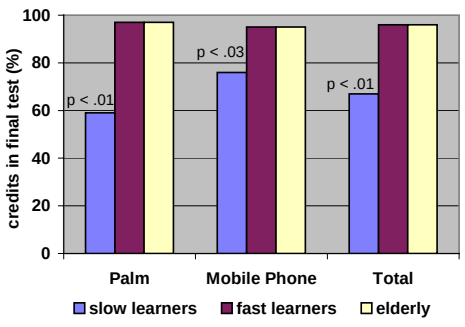
Training:



- Seniors practiced significantly more functions than patients for the Palm and totally.

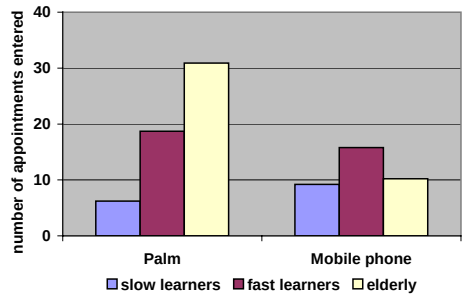
Based on the progress during training patients were subdivided into two groups of fast (N=6; learned all 10 tasks) vs. slow learners (N=6; learned less than 10 tasks).

Final test:



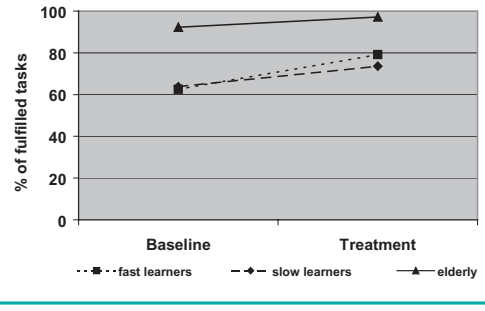
- Elderly subjects, as well as fast learners performed significantly better than slow learners and reached almost full credits.
- Slow learning patients seem to have more problems with entering intentions into the Palm than into the mobile phone (p=.07).

Appointments entered during treatment:



- During treatment subjects preferred using the Palm compared to the mobile phone, since more appointments were entered into the Palm (21.7 vs. 11.7; Z = 2.6; p <.011).
- Group differences were observed only for the Palm (X2 = 7.9; p < .019): Slow learners entered less intentions into the Palm than fast learners (Z = 2.2; p < .026) and elderly (Z = 2.6; p < .007).

Benefit of using an electronic device:



- Elderly fulfilled significantly more tasks than patients during both baseline (X^2 = 11.0; p < .004) and treatment (X^2 = 10.0; p < .007). No differences were observed between fast learner and slow learner.
- For all three groups the use of electronic memory aids led to an increase in experimental tasks completed (Z = 2.9; p < .004) and there were no significant differences in the rate of improvement (differences between baseline and treatment) between the three groups (p =.13).

Neuropsychological Assessment:

Table 2: Spearman Rank Correlation between neuropsychological control variables and experimental variables

			Final test % of possible points	Baseline % of fulfilled experimental tasks	Treatment % of fulfilled experimental tasks
Attention	TAP - Simple reaction time	RT	.19	.31	.29
Short term memory	WMS - Digit span forward	Items	.26	.07	.17
Working memory	Digit ordering Test	Items	.23	.52*	.70**
Immediate recall of verbal and figural information	WMS-R - MQ	Index	.39	.65**	.52*
Executive function	BADS - six elements	Raw score	.29	.23	.29
Intelligence	MWT	IQ	.21	.34	.41*

Note: * p < .05; ** p <.01; BADS: Behavioural Assessment of Dysexecutive Syndrome; MWT: Mehrfachwahlwortschatztest [Multiple choice vocabulary test]; TAP-test (Testbatterie zur Aufmerksamkeitspr fung [Test of Attentional Processes]; WMS-R: Wechsler Memory Scale-Revised

- As table 2 shows, no significant correlation were found for the performance on the final test after training, while baseline performance on prospective memory tasks and the outcome with the electronic aid was based on memory (WMS-R), as well as working memory (Digit ordering task) performance. In addition outcome was related to measures of intelligence (MWT).

Discussion

- Healthy elderly subjects are able to learn the use of commercially available electronic devices with an individually tailored training. Subjects were, however, mainly high-functioning seniors. Nevertheless in an questionnaire subjects asked for changes for the display e.g. font size, better readability in unoptimal light conditions.
- Although their baseline performance was already very good, they were still able to improve their performance with the help of electronic memory aids. The Palm seemed to be more convenient than the mobile phone, since more tasks of their own were entered into the Palm by the subjects.
- In contrast, only mildly impaired patients were able to learn the use of the devices, despite of an intensive training. Slow learners had more problems in dealing with the Palm, while fast learners preferred it. There was, however, no difference concerning efficacy of the devices between Palm and mobile phone or between slow and fast learners. Therefore, once the data are entered commercially available electronic memory aids are able to improve patients' performance.
- Even with the help of the devices, however, patients' performance was significantly worse than that of the elderly subjects. Thus further improvement may be possible with a memory aid especially tailored for the patients' needs. MEMOS, an interactive system developed at the University of Leipzig (Thöne-Otto & Walther, 2003), was designed in order to fulfil these requirements.

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