# Cellular Phone Manuals: Users' Benefit from Spatial Maps

**Susanne Bay**
Psychology Department
Aachen University
52062 Aachen, Germany
+49 241 8099372
Susanne@psych.rwth-aachen.de

**ABSTRACT**
Manuals of technical devices are often not very helpful to the user. This study investigates the influence of spatial instructions versus linear step-by-step manuals on inexperienced users' performance handling cellular phones. Results show a significant interaction between user age and manual. Middle aged users profit from the spatial information given in the manual that contains the phone's menu tree in relation to the step-by-step instruction, whereas subjects older than 50 show no improvement. It can be concluded that manufacturers should consider the inclusion of spatial information on the cellular phones' menu structure in their manuals, as the majority of users would benefit.

**Keywords**
Cellular phone, manual, spatial map, menu tree

**INTRODUCTION**
Cellular phones are a widespread example of a menu-driven technical device whose usage still imposes difficulties on many users. Manuals are typically thick and uncomfortable to read. Most of the manuals contain step-by-step instructions, failing to transport the inherent structure of the phone's menu-tree. Yet, spatial orientation during navigation is presumably of importance for successful interaction with a technical system. If this kind of orientation can be compared with orientation in the natural environment (as it is assumed for navigation in hypertext [1]) survey knowledge which is provided by a spatial map of the menu organization should be helpful.

Regarding navigation in a hierarchical menu structure of a personal computer (PC) a number of experiments have been conducted. Some [e.g. 2, 3] showed that subjects when given a map of the menu organization improved their performance, whereas other studies [e.g. 4] revealed no performance differences. As cellular phones dispose of very small displays where only small sections of the menu can been seen at a time the use of spatial maps may have other effects than in computers with large screens. It is therefore interesting to explore the effect of a spatial manual on inexperienced mobile phone users when solving tasks on the device.

**METHOD**

**Participants**
In the study 36 participants, aged 32 to 61 took part. Mean age was between 43 and 45 in all three conditions.

**Material**
A cellular phone that mirrored the Nokia 3210 regarding menu structure and keys was simulated on a PC with touch screen. User actions were recorded online to determine time spent on task and detour steps (keystrokes that did not lead directly to the solution).

The navigational aids given to the participants were a tree structure containing the functions relevant for task solution (figure 1, left), an empty menu tree with the right path marked (figure 1, right), or a step-by-step instruction informing about the functions to be selected sequentially (figure 2).

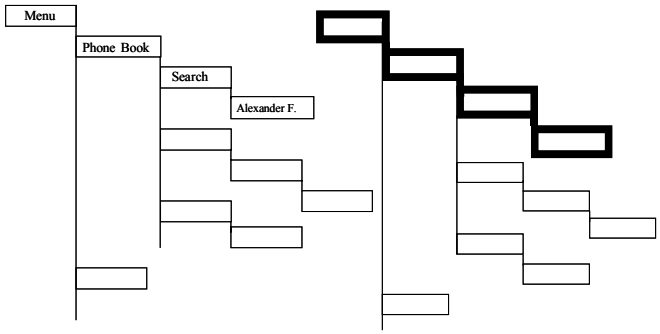


**Figure 1.** Extracts of tree structure navigational aids containing relevant functions (left) or a marked path (right).

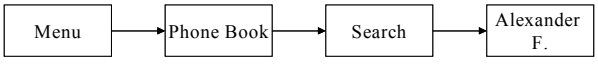


**Figure 2.** Example of a step-by-step navigational aid.

**Procedure**
The participants were asked to solve four different tasks on the simulated cellular phone twice consecutively: calling someone using the internal phone book, sending a short message, hiding the own phone number when calling and editing a number in the phone book. In the first trials, after

reading the task, the participant was given the opportunity to study the specific navigational aid for 20 seconds. Then the aid was removed and the subjects began processing the task, in the meanwhile being allowed to reread the task but not to consult the navigational aid. When the four tasks were processed for the second time, no navigational aid was given in order to measure learnability.

## RESULTS

The means for the different navigational aids after eliminating extreme values can be seen in table 1. Numerically, differences in time on task between the step-by-step and the tree structure navigation aid are apparent.

**Table 1.** Time on task [min] (N=30)

| | Navigational aid | | |
|---|---|---|---|
| | Step-by-step | Tree with functions | Tree with path |
| **Tasks 1-4** | 12 | 9.5 | 11.3 |
| **Tasks 5-8** | 7.4 | 6.2 | 5.1 |
| **Tasks 1-8** | 19.5 | 15.7 | 16.4 |

But, as no statistically significant effects of navigational aid on time on task could be detected when taking all subjects together, a deeper look into the data was necessary. A gap between older and younger participants' performance caught the eye. Thus, they were divided into two age groups, 32-50 years and 51-61 years.

Analysis of variance showed a significant effect of age group for solution time in the first trials ($F(2,24)=7.36$; $p<.01$) and the eight tasks taken together ($F(2,24)=15.7$; $p<.01$) as well as for the number of tasks solved in the first trial ($F(2,24)=5.37$; $p<.05$). A significant interaction of age group and navigational aid was found for solution time in the first trials ($F(2,24)=4.42$; $p<.05$). Figure 3 shows that both groups performed roughly equally well using the step-by-step instruction, however, middle aged people benefited from the spatial menu tree improving their performance tremendously whereas older subjects had major difficulties when using the tree structure compared to the sequential navigational aid.

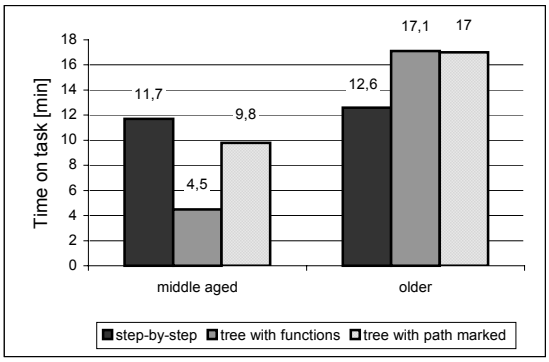


**Figure 3**. Time on task for tasks 1 to 4 with different manuals.

For the middle aged group the difference between the step-by-step instruction and the menu tree containing functions is statistically significant regarding time on task ($F(1,11)=6.0$; $p<.05$) and detour steps ($F(1,11)=7.2$; $p<.05$) in the first trials.

Learnability and its interaction with navigational aid as well as with age was assessed. A three way interaction between navigational aid, age and learnability on users' performance was detected for time on task ($F(2,24)=6.4$; $p<.01$) and detour steps ($F(2,24)=4.3$; $p<.05$). Older subjects had the biggest improvement in the "tree with functions" condition accelerating from 17 minutes for the first four tasks to 7.6 minutes in the second, whereas the middle aged took less time (5 minutes) in both trials without improving their performance after using this navigational aid. With the step-by-step aid both groups improved comparably from 11.7 to 6.8 minutes (younger), and from 12.5 to 8.4 minutes (older), without reaching the performance of the group using the menu tree in the second trial.

## DISCUSSION

Results of this study confirm the hypothesis of a general superiority of navigational aids containing a spatial menu tree only for the younger group (32-50 years). Participants aged 51 to 61 had difficulties using this spatially demanding instruction. Latter results confirm findings that spatial abilities can decrease with age. Nevertheless the majority of users would presumably profit from manuals containing the menu structure. Further research has to be directed towards the question of how to improve spatial navigation aids in order to be comprehended more easily (e.g. by elderly people) and how the devices themselves can make their menu-structure more transparent to users.


## ACKNOWLEDGMENTS

I thank Simone Könen for her support collecting data and Martina Ziefle for irreplaceable ideas and encouragement.


## REFERENCES


1. Farris, J.S., Jones, K.S. & Elgin, P.D. (2001). Mental representations of hypermedia: An evaluation of the spatial assumption. In *Proceedings of the Human Factors and Ergonomics Society 45th annual meeting*, 1156-1160.
2. Billingsley, P.A. (1982). Navigation through hierarchical menu structures: Does it help to have a map? In *Proceedings of the Human Factors Society 26th annual meeting*, 103-107.
3. McDonald, S. & Stevenson, R.J. (1998*)*. Navigation in hyperspace: An evaluation of the effects of navigational tools and subject matter expertise on browsing and information retrieval in hypertext*. Interacting with Computers 10*, 129-142.
4. Pak, R. (2001). A further examination of the influence of spatial abilities on computer task performance in young and older adults. In *Proceedings of the Human Factors and Ergonomics Society 45th annual meeting*, 1551-1555.