The Environment: a Source of Capabilities for Older Adults?

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ABSTRACT

This article presents an exploratory study on older adults' mobility. The study was based on both observations in a complex built environment (a university hospital), and on an online questionnaire distributed to people aged 50 and more. The main objective of the two studies presented in this paper was to determine the difficulties encountered by older adults when moving outdoors and indoors. A secondary objective was to investigate the resources used in order to cope with the difficulties. The results shows that the main mobility obstacles for older adults are related, firstly, to the salience of landmarks and the spatial organization of the environment and, secondly, to the age-related decline in physical, sensory and physiological abilities. Our studies show that the main resources to overcome these obstacles are landmarks and personnel support in the hospital and Internet, GPS, plans and maps outdoors.

Authors Keywords

Environment; Older Adults; Compensation; Capability.

ACM Classification Keywords

H.1.2 [**Models and Principles**]: User/Machine Systems — *Human factors, Human information processing*

General Terms

Human Factors; Experimentation

INTRODUCTION

The aging of the population involves changes in different activities such as mobility. Studies on aging suggest that there are mainly changes in physical and cognitive capacities (e.g. walking speed [7], cardiorespiratory capacity [12], memory and attention [16]). On the average, these capacities tend to deteriorate starting from the age of 50. However, some authors [2, 11] show that older adults use compensatory strategies to cope with this decline and that not all cognitive and physical capabilities decline with age [4]. An example of a compensation strategy used by older people is avoiding driving in challenging circumstances [6]. Thus, with aging, individuals continue developing new skills. This development requires resources for learning.

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In mobility, these resources are landmarks (e.g. signage), route knowledge (i.e. actions associated with landmarks) and survey knowledge (i.e. distance and directional relation- ships between landmarks). "These kinds of knowledge help guide people's actions in adaptive ways, in other words, so that their behavior is coordinated not only to the environment as perceived but also to the environment as conceived and remembered" [9]. Landmarks are fundamental to the efficient navigation [1]. They are preferentially selected by people for their content, form, color, and prominence [13].

The main objective of the two studies presented in this paper was to determine the difficulties encountered by older adults when moving outdoors and indoors. A secondary objective was to investigate the resources used in order to cope with the difficulties. A special focus was put on environmental resources and their role for helping older adults to compensate age-related decline in physical and cognitive abilities.

The paper is organized as follows. The first part presents the methodology of the two studies. The second part presents the results of the studies and a related discussion. The last part reflects on a number of limitations of the studies and the perspectives for our future work.

METHODOLOGY

The two studies are based on the use of two different methods, which are 1) open preliminary observations of older adults moving indoors, in a University hospital, and 2) an online questionnaire on older adults' mobility patterns and habits when moving outdoors. We were interested in these two aspects of older adults' mobility, since our studies were conducted as a part of a European project, called ENTRANCE, targeting the development of interfaces for facilitating older adults' mobility indoors and outdoors (http://www.entrance.fr/).

As for the choice of the University hospital, it was selected because of the important number of older adults visiting it and because of its complex spatial organization. In fact, it was a 14-floor building comprising 9 regular floors, a ground floor and two basement floors. Another reason for choosing this hospital was the demographic characteristics of the region in which it is located (i.e. the Limousin). With 21% of its inhabitants aged 65 and over, and its population having started to decline between the 1982 and 1990 censuses, the Limousin foreshadows the France of the 2020s (for more details see http://www.insee.fr/fr/ffc/docs_ffc/cs74a.pdf).

The methodologies of the two studies are presented in more details below.

Preliminary observations

There were 32.5 hours of open observations done over 5 days, during the regular working hours. No pre-established observation guide was used. The objective of the observations was to collect older adults' difficulties in terms of orientation, navigation, as well as the use of environmental resources to cope with these difficulties. Thus, we focused on the effects of the spatial organization of the hospital, of time and physical constraints and of informational resources on older adults' mobility. We also observed and registered older patients' and visitors' interactions with the hospital staff.

Subjects

We observed patients and visitors aged 50 or more. This choice can be explained by the fact that these are the elderly of tomorrow who could be the potential users of the technologies developed in the ENTRANCE project. We ob- served older adults moving without any difficulty, but also older adults who seemed lost and or searching for orientation information (e.g. signage or landmarks).

Chosen locations

When observing, we were standing at strategic locations such as lobbies, waiting rooms, reception desks, elevators accesses, parking lots, corridors. These locations were chosen on the basis of a literature analysis on problematic points for older adults' mobility [8, 15]. The choice of locations was also discussed and approved by the hospital staff.

Coding scheme

The notes taken during the observations were transcribed. A content analysis was performed on the data. Based on the content of the transcripts, the relevant literature on older adults' mobility and on discussions with the hospital staff, we defined the following coding categories:

1. Spatial organization: it is the physical aspect of the hospital as well as the distribution and organization of different services and levels.
2. Time and flow effects: these are mainly the peaks in hospital attendance.
3. Landmarks: signage, information points.
4. Staff responses to questions from patients and visitors.
5. Personal characteristics such as anxiety and stress.

This coding scheme was then applied to the transcripts of the observations.

A complementary coding of all the units in the 5 above-mentioned categories was then done. The objective of this second coding was to define, within each of the 5 categories, the obstacles, the resources and the neutral elements used by older adults when moving in the hospital. We define as obstacles the elements disturbing fluid mobility, e.g. the complex spatial organization of the hematology unit. We define as resources the elements with specific utility for mobility and navigation. A typical example is the presence of medical assistants near the elevators. Because elevators are a strategic location, such a presence facilitates orientation of lost visitors and patients. The neutral elements do not satisfy either of these definitions.

The units within the category "Landmarks" were further recoded. The objective was to determine whether the difficulties and the resources from this category were related to the content (i.e. the meaning conveyed by an informational element provided by the environment) or the form of this informational element. The form of the elements concerns the media on which it is presented (e.g. paper, traffic sign, etc.). Also, a complementary coding of the category "Spatial Organization" was done to determine whether the obstacles and resources within this category are related to a (mis)understanding or an interaction between the visitor/patient and the environment.

Online questionnaire

The online questionnaire consisted of 20 questions. Its objective was to collect information on the daily mobility pat- terns of older adults (aged 50 and more). In this paper, we only focus on the data related to mobility difficulties and the navigation support used by older adults. We had 234 volunteer respondents (i.e. 140 persons aged 50 to 64; 76 aged 65 to 74; 18 aged 75 and more, all of them living in France).

RESULTS AND DISCUSSION

Preliminary Observations

Figure 1 shows a clear tendency noted during the preliminary observations. The environment seems to cause more difficulties (47%) to older adults than it provides mobility resources (28%). However, this observation should be put in perspective, since an observer usually focuses on difficulties in human activity.

Our results suggest that the difficulties are mainly related to the spatial organization, to the landmarks available in the environment and to time and flow constraints. For example, in busy periods, the reception is not visible, or there are long lines. In this case, it could be identified as an obstacle for some hospital users. In contrast, when the flow is limited, the reception is easy to locate and may be serve as a useful resource for orientation. Personal characteristics (Figure 1) do not seem to play an important role in mobility. Again, this result should be put in perspective, as it is related to the method used (i.e. open observations rather than observations of individual activity). The evaluation of the effects of personal characteristics on older adults' mobility requires a detailed analysis of individual activity (e.g. using interviews).

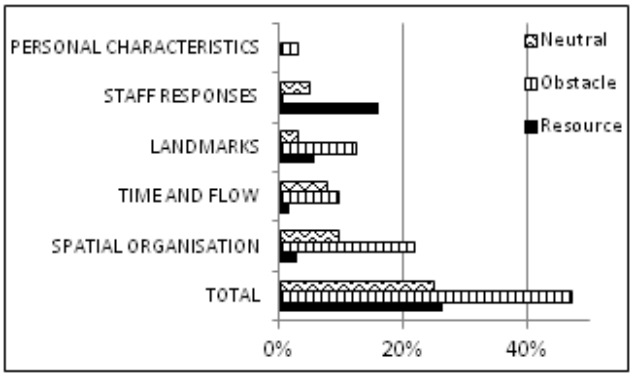

Figure 1: Environmental resources and obstacles

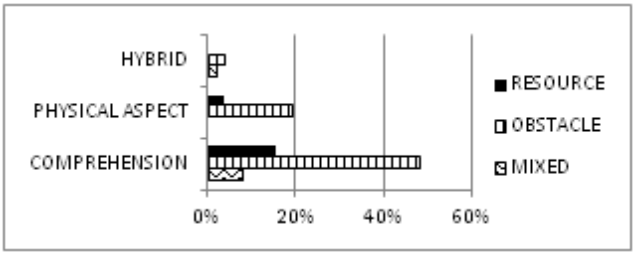

Figure 2: Spatial Organization

To understand why environmental elements could be either an obstacle or a resource, a deeper data analysis was done. The results of this analysis showed that the difficulties rooted in the spatial organization of the building were mainly due to the understanding that the users had of this organization (Figure 2). In the same time, several studies show that comprehension difficulties result in difficulties in constructing a meaningful representation of space [8]. In our study, the older adults' problems with spatial organization were mainly due to the disposition of a hospital service on several floors.

The category "Landmarks" (Figure 3) includes information provided by traffic signs, maps, as well as by oral route descriptions. For this category, the form rather than the con- tent of information provokes orientation and mobility difficulties. In our study, the main problems are due to the graphic layout of the informational support, their localization, as well as their large variety. According to part of the hospital personnel, these elements might provoke informational overload in users.

Though in our study, the environment is often perceived as an obstacle, it may be a valuable resource for older adults' mobility. As shown in Figure 1, the medical staff is the main resource used to find one's way in the hospital. Users also use landmarks, route descriptions given by receptionists and audio information in lifts. For all these supports, the most problematic aspect is their form (Figure 3).

Online Questionnaire

Figure 4 shows the main difficulties encountered by older adults in their mobility. Firstly, it is clear that with aging, the number of individuals experiencing difficulties increases.

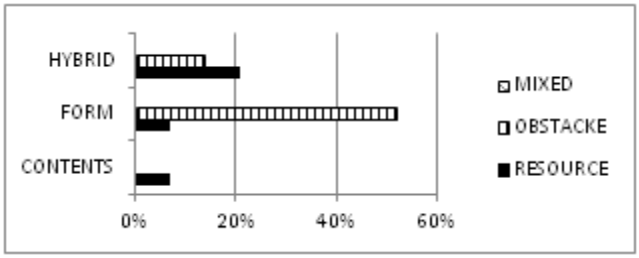

Figure 3: Landmarks

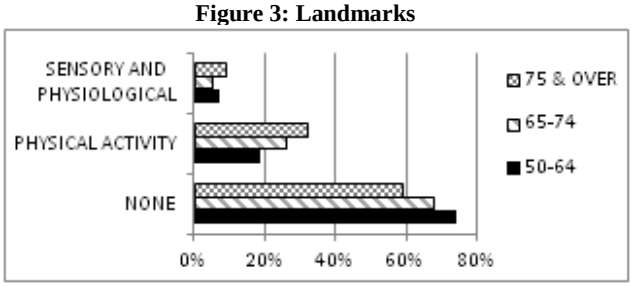

Figure 4: Mobility difficulties

Thus, after 75 years, more than 40% of the respondents re- port difficulties when moving around. These difficulties are mainly due to physical problems (e.g. difficulties to carry heavy bags when walking) and to sensory and physiological limitations (e.g. cardiac, respiratory, visual, auditory problems). This may mean that the environment is not adapted to the mobility needs of older adults or that its physical characteristics provoke difficulties to their navigation and orientation. Physiological and sensory difficulties, though important, do not seem the main obstacle for older adults' mobility.

Figure 5 shows the frequency of travel outside one's home according to the age group. Two phenomena seem to appear. The first one is that the frequency of travel decreases with advancing age. The second one is that the respondents aged 75 and more move more often than 65-74. However we suppose that if they move more frequently, they cover shorter distances compared to the group aged 65-74. We can thus assume that the people aged 75 and more differ from other age groups in terms of mobility practices.

Figure 6 shows that with the advance in age, people tend to use more navigation aids (e.g. technologies, route descriptions, classic maps). Moreover, with cohorts' effects we can imagine that older people of tomorrow will use more technology. However, there is an exception in the group of seniors aged 75 or more, who tend to use technology less often. This tendency may be explained by a generational effect or by the limited need of such technology if moving on short distances.

Figure 7 shows the resources used by older adults when moving around. Technologies (GPS and Internet) seem to be used very often as navigation support. It is probably because older adults have better performance in navigation with these technologies [5]. However, mobile interface (e.g. phones and tablets) appear to be less widely used. It is possible that this type of resources is less used because they are too complex or because their main functions are not adapted to older adults' needs. However, as noted above, this analysis does not sufficiently integrate the individual user's activity.

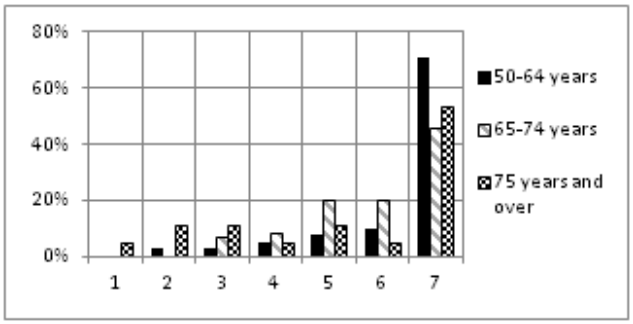

Figure 5: Weekly frequency travel

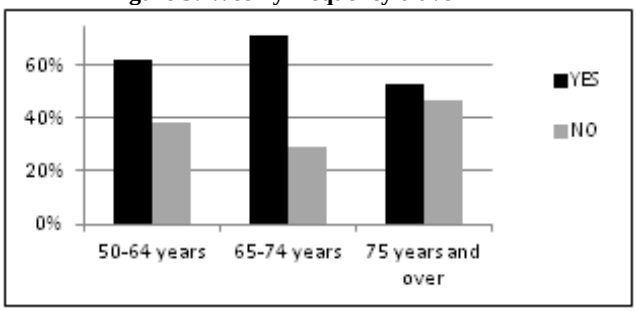

Figure 6: Use of technologies and other navigation aids

Also, older adults use very little environmental information (e.g. billboards, traffic signs, audio information). If people rely on aid other than environmental information, it may mean that these resources are not sufficient for older adults to find their way. This could also mean that the built environment is not affordable or missing resources are not directly accessible and / or usable.

The results from our preliminary study show that environmental resources are crucial for the success or failure of older adults' navigation and orientation activity but they are not sufficient. Furthermore, we can suppose that resources or obstacles are different according to age (Figure 4) and practice (e.g. Figure 5).

LIMITATIONS, IMPLICATIONS FOR DESIGN AND FUTURE WORK

The exploratory study presented in this paper shows an activity analysis focused on the relationship between individuals and the environment in which they move. It highlights the role of the environment in mobility (and activity, in a more general perspective). It also questions the potential of this environment as a learning resource and a support for the compensation mechanisms used by older adults in their mobility. We think that taking into account the changing environment influencing directly and indirectly older adults mobility, is a valuable perspective to explore. Of course, as a preliminary study, our study has a number of limitations summarized below.

Limitations of the studies

Thus, the interaction between older adults and the environment in which they move has been evaluated on the basis of observations and a questionnaire on daily mobility patterns.

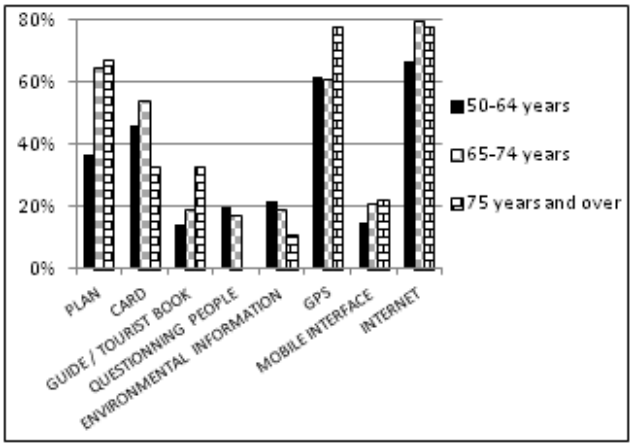

Figure 7: Types of environmental resources

For this reason, interviews and more detailed observations will be done in the future. Furthermore, the questionnaire was conducted online, which limits the respondents to people al- ready using information technologies in their daily life. In the future, we will complement this data by data based on interviews and observations of non-users of information technologies.

Implications for accessible design

Firstly, our preliminary observations indicate that older adults' difficulties when moving in complex built environments are mainly due to the media and the form in which landmarks is provided. Thus, graphical layouts may provoke difficulties in spotting in reading information. Another difficulty concerns complex spatial organization of indoor environments. The complex spatial organization of the building in which the preliminary observations were done lead to comprehension difficulties, which, in their turn, impeded the intuitive perception and use of environmental resources. In this sense, in our study, the architecture of the hospital does not seem intuitive. On the contrary, intuitive complex built environments would provide informational clues which could naturally and intuitively guide the older adult to his/her destination. However, as it is not enough to dispose of the necessary resources, the design should also provide the conditions for using these resources (e.g. learning technologies, variety of ways for achieving the same goal, etc.). Designers should also work on solutions that help users more easily integrate the logic of space, make landmarks more salient and construct a mental map of the environment.

Also, the online questionnaire suggests that with aging people travel less. This tendency is probably due to the age-related decline in walking or cardiorespiratory capacities. Thus, a good design should also allow older adults to compensate age-related sensory and physical limitations. A potentially useful design orientation can be the capability approach [17, 3], supporting the design of environments which allow older adults to develop new skills and knowledge, broaden their activity space and their control on the situation, as well as their autonomy. This approach could support the design of technologies enabling personalization of information and embedding learning elements.

Methodological perspective

This study questions the role of the environment as a mobility resource that helps older adults to compensate declines. When a person is engaged in mobility, his/her productive activity is focused on his/her interaction with the material and symbolic elements of the environment, as well as on their transformation according to task (e.g. go to a medical visit). The person then controls his actions through- out the activity to adapt to the context. Thus, he/she is involved in a constructive activity. This constructive nature of activity may provoke a change in the environmental re- sources used by the person, especially when the goal of the activity changes [14]. When this happens, the environment which was not earlier in the main focus of attention - i.e. the peripheral environment - can become a useful resource. In ergonomics, the analysis of the role of the environment for human activity has mainly been focused on the very close environment with which the person interacts (Figure 8).

The environment, in a larger perspective (i.e. not directly sup- porting actions or activities), is often neglected. We propose to consider the peripheral environment in the analysis of the activity because it participates in the regulation thereof (Figure 7). For example, an analysis of the activity of walking would rarely take into account the possibilities offered by the environment such as other types of transportation (e.g. public transportation or taxi). What we propose is to take into account the potential offered by the environment when designing for mobility. The potential of the environment should be considered as a new "open avenue" that enables people to cope with the variability of situations and thus to compensate age-related decline.

However, this "peripheral" environment may become important when the goal of the activity changes dynamically, or when people encounter obstacles creating situations of disability.

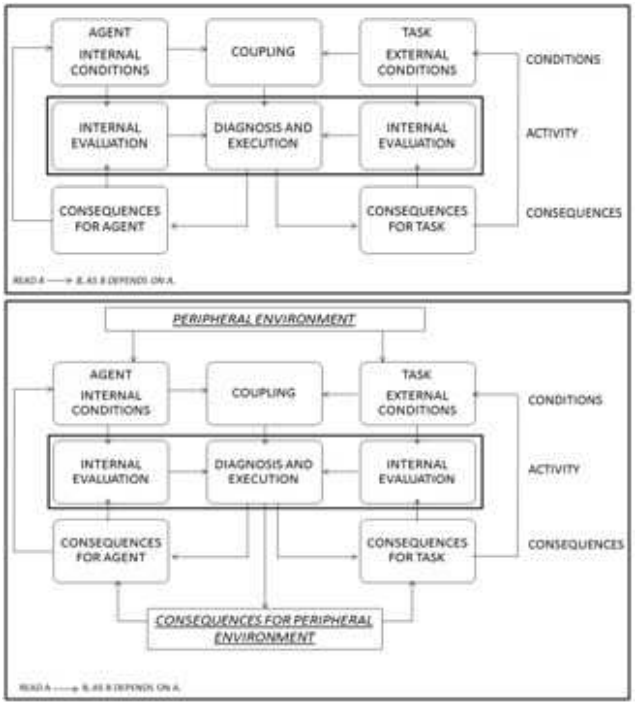

Figure 8: Activity pillars (Translated and adapted from Leplat, 2006, [10])

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