WAYFINDING IN A NURSING HOME FOR ADVANCED DEMENTIA OF THE ALZHEIMER'S TYPE

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ABSTRACT: The aim of the study was to generate design criteria in order to encourage and facilitate wayfinding for advanced Alzheimer's patients. Two sources of data were used: interviews with the staff of a typical urban nursing home, and a wayfinding experience with its residents. The results show that even patients with severe cognitive deterioration are able to reach certain destinations. Wayfinding decisions have to be based on environmental information that is readily accessible, so that the patient can proceed from decision point to decision point. Monotony of architectural composition and the lack of reference points render wayfinding difficult. The elevators are seen to be a major anxiety-causing barrier. Visual access to the main destinations increases their use and facilitates wayfinding. Signage has an important function,

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creating redundancy in wayfinding communication and compensating for the loss of memory and spatial understanding. Floor patterns and dark lines or surfaces can disorient the patients and cause anxiety.

In Canada, 10.6% of the population was age 65 and above in 1991. This age group is assumed to increase to 14.5% in 2011 and to 21.8% in 2031 (McDowell et al., 1994). Dementia affects up to 8% of the population of 65 or older. Dementia of the Alzheimer's type (DAT) counts for about 50% of all forms of dementia (McDowell et al., 1994).

In addition to memory deficits, spatial disorientation is among the first and persistent manifestations of DAT. Orientation and the ability to reach destinations (wayfinding) are the prerequisites of personal autonomy and quality of life. Their deterioration is a prime reason for institutionalization. Recent work on DAT with moderately affected patients shows that certain wayfinding abilities are still functional (Passini, Joanette, Rainville, & Marchand, 1998). These residual abilities are the basis for designing adapted settings and, in more affected populations, a therapeutic milieu giving its patients as much autonomy as possible. Little is known about advanced DAT and wayfinding. Being progressively more dependent on the environment, it can be argued that the latter takes on an increasingly important role.

The aim of the present study was to identify wayfinding abilities as well as wayfinding difficulties in advanced dementia patients residing in a typical nursing home. It is believed that this knowledge might lead to supportive design interventions for optimal mobility and quality of life for its patients.

LITERATURE

WAYFINDING AND SPATIAL ORIENTATION

In the literature of psychology and environmental psychology, the notion of "wayfinding" was preceded by "spatial orientation," which refers to a person's ability of mentally imagining or representing a physical setting and of situating him or herself spatially within that representation (Passini, 1984). This mental representation, referred to as a cognitive map, relies on a structuring process of integrating into an ensemble that is perceived in parts (Downs & Stea, 1977).

The concept of wayfinding emphasizes the processes involved in reaching destinations (Kaplan, 1976; Passini, 1977; Downs & Stea, 1977). In the context of a new wayfinding task, they can be modeled as being (a) decision

making and the development of a plan of action; (b) decision execution, transforming decisions and the decision plan into physical behavior; and (c) information processing comprising environmental perception and cognition, underlying both of the decision related processes. Wayfinding, in other words, can be seen as a problem-solving process with a particularity: it operates in space and requires spatial information. Thus the processing of information has to include cognitive mapping. In the context of a known task in a familiar environment, decision execution and information processing are required. Others (Gärling, Böök, & Lindberg, 1986) have expressed similar views.

Wayfinding, seen in terms of spatial problem solving incorporates spatial orientation, but it views a cognitive map as a source of information to be combined or partially replaced by other types of information necessary for making and executing decisions. The link between cognitive maps and wayfinding ease has been investigated, among others, by Gärling and Golledge (1989) and Rovine and Weisman (1989). The results generally show that people who do present a clear cognitive map also experience ease in wayfinding.

WAYFINDING IN DAT

Problems of disorientation and wayfinding have been noted by a number of authors (Cummings & Benson, 1992; Liu, Gauthier, & Gauthier, 1991; Namazi, Rosner, & Rechlin, 1991; Puel, Demonet, Ousset, & Rascol, 1991). Disorientation and loss of memory are the two key factors to interfere with social adaptation of DAT (Richard, Bizzini, Arrazola, & Palas, 1979, 1981). They are also considered among the first and clearest signs of dementia (Chenoweth & Spencer, 1986; Rainville, Passini, & Joanette, 1994).

Different scales describe the progressive decrement in cognitive functioning of DAT, including wayfinding. For instance, according to the Global Deterioration Scale (GDS) (Reisberg, 1985; Reisberg, Ferris, & Crook, 1982; Reisberg, Ferris, Franssen, Kluger, & Borenstein, 1986), it is in DAT Stage 3 that the initial symptoms appear. In addition to light memory deficiencies, patients tend to get lost when traveling to an unfamiliar location. Stage 4 corresponds to a light to moderate deterioration of intellectual abilities. Mobility, in terms of being able to reach chosen destinations, starts to be impaired, and patients experience difficulties on a more local scale. At this stage they are still able to move about in familiar places. During Stage 5, patients need help in their daily activities and autonomous mobility is further reduced; frequently, some disorientation to time or place exists as well. At Stage 6, deterioration of most intellectual activities is severe; patients will

require travel assistance but occasionally will display an ability to go to familiar locations. Evaluations done on the basis of other scales show that topographic disorientation is present in the initial stages of DAT. It has been suggested that disorientation problems are first apparent at the urban and regional macroscale and only later at a local scale (Barbizet, 1970; Müller & Wertheimer, 1981).

The main sources of information concerning disorientation problems in DAT are clinical descriptions of individual cases. Relatively few systematic studies have been undertaken to understand the underlying causes of wayfinding difficulties in DAT. When studies on disorientation are undertaken, they tend to be conceptualized exclusively as a spatial representation and cognitive mapping problem. They include such tasks as pointing in the direction of invisible objects, locating cities on a geographic map, or describing the spatial arrangement of a room. Spatial representation abilities have been investigated within the framework of Piaget's genetic psychology. This developmental approach allows for an analysis of the course of deterioration (De Ajuriaguerra, Rey-Bellet, Muller, & Tissot, 1964). In a series of studies, Alzheimer's participants have been shown to exhibit deterioration in the manipulation of projective and Euclidean space relations (Bizzini, 1985; Boehme, 1973; Mietkiewicz, 1981; Rainville, 1992; Richard et al., 1981).

Passini, Rainville, et al. (1995), and Passini et al. (1998) have identified specific wayfinding problems for patients with moderate DAT when trying to reach a destination in an unfamiliar hospital setting. Although the patients were able to make certain decisions, they were incapable of planning a solution to the relatively complex wayfinding problem they were given. Not being able to plan, which is an essential aspect of complex problem solving, they were constrained to function in an incremental and sequential fashion from decision point to decision point. The study also outlined the participants' difficulty of distinguishing relevant from irrelevant information. Cognitive mapping, in the wayfinding context of a hospital environment and also in the context of a laboratory research, showed significant signs of deterioration (Passini, Joanette, et al., 1995).

THERAPEUTIC ENVIRONMENTS FOR DAT

Traditional institutions, quite apart from their positive contribution in terms of security, availability of care, and medical services (Adam, 1996), also may have deleterious consequences. According to Montambeault and Bergman (1997), the effects can be of a medical order, such as increased immobilization and consumption of medication; of a psychological order, such as anxiety, depression, loss of personal esteem, and suicide; and of a

social order, such as loss of privacy, isolation, and loss of self control. Approaches to health care for the elderly affected by DAT have evolved from an institutional and a medical model, where disease control took center stage, to a more humanistic model emphasizing normal living conditions and quality of life as much as possible. This therapeutic environment reintroduces the individual and his or her values (Kitwood, 1995) and strives for the elderly patient's freedom of choice, respect for privacy and human dignity, access to social and recreational activities, and a pleasant atmosphere encouraging interactions and creativity (Coons & Mace, 1996).

The relation between people and their physical environment (person/ environment relations) has been a fertile ground for gerontology. A popular thesis has been that a person's handicap is not the result of a deficiency alone, but the combination between the deficiency and an incompatible physical and care environment. The physical environment has a major role in compensating for deficiencies and in maintaining residual mental and physical abilities (Baltes & Baltes, 1990; Calkins, 1988; Cohen & Weisman, 1991; Coons, 1991; Hall, Kirschling, & Todd, 1986; Hiatt, 1986; Lawton, 1982; Verbrugge & Jette, 1994).

Three design aspects concerning therapeutic environments have been outlined in the literature: (a) the general character of the setting, (b) the spatial organization of the unit, and (c) the design of specific spaces (Calkins, 1988; Cohen et al., 1988; Cohen & Weisman, 1991; Gutman, 1989; Weisman et al., 1991). The general character of the setting refers to the creation of an environment that is noninstitutional by the choice of appropriate materials, lighting providing a residential type atmosphere, the presence of objects that have significance for the patients, and the presence of sensory stimulation without creating conditions of stimulation overloads. Of particular importance is the scale of the setting, which should remain residential and should house patients in small groups. The spatial organization of the unit has to reflect a variety of spaces for various activities and social interactions indoors and, if possible, outdoors as well. With respect to the design of specific spaces, it is noted that one's bedroom is a place of refuge, and therefore a facility should allow a patient to personalize the space by the use of furniture and decorative elements, thus providing a link with the past. The common rooms (i.e., living room, eating room, and kitchenette) have to reflect the small scale of the residential units. This information, it should be noted, is not necessarily empirically derived and substantiated.

Various authors (Dickinson, McLain Kark, & Marshall-Baker, 1995; Kociol & Schiff, 1989; Zgola, 1987) have investigated the problem of aimless wandering. Wandering differs from wayfinding in that the person walks without having a destination in mind and without knowing where she or he is.

McGrowder-Lin and Bhatt (1988) proposed the provision of adequate wandering space. Wandering spaces are often designed as loops that allow a person to walk without being interfered with by staff and without hitting dead ends (Thomas, 1995).

The literature suggests the importance of wayfinding in the design of therapeutic environments. At the same time, little is known about the wayfinding abilities that remain functional in advanced DAT. It seems reasonable that an understanding of these abilities should be the basis for designing supportive therapeutic settings, that is, to allow an optimal degree of autonomy.

OBJECTIVE OF THE STUDY

The objectives of the study were the following:

1. To identify residual wayfinding abilities in advanced DAT;
2. to identify architectural, interior design, and graphic features that cause wayfinding difficulties or that facilitate mobility in DAT; and
3. to identify aspects of nursing home care that impinge on spatial mobility of DAT patients.

METHOD

Two complementary methods were used for collecting the data: (a) interviews with staff and administrative members of the nursing home and (b) a wayfinding experience with a small number of patients reflecting different degrees of deterioration at the advanced scale of the disease.

THE PARTICIPANTS

To obtain a variety of observations, 10 staff members that could be assumed to have different and complementary experiences were interviewed on an individual basis. They were composed of the director of the nursing home, a security agent, an occupational therapist, a physiotherapist, a recreation guide, 2 orderlies, and 3 nurses including the head nurse. The selection criteria required them to have worked at the center for at least 4 months.

Six Alzheimer's patients participated in the wayfinding experiment, which was designed in terms of a multiple case study. In accordance with our research objectives, variety and richness of the data was sought rather than

representative values. The participants were chosen from different floors of the home, thus representing the small variations that were found in the physical setting and care strategy. The sample also had to reflect orientation and wayfinding difficulties of patients and cognitive deterioration characteristics. They had to be living in the nursing home for at least 1 month. A final criterion was the patients' ability to respond to the tasks of the experiment. The age span was between 76 and 94 years; all participants were females. The staff member helped us in the selection of the sample. The key characteristics of the sample are summarized in Table 1.

The scores of the Mini Mental State (MMS) indicate a severe mental deterioration with the exception of Participant 4. In the case of Participant 5, language problems made it impossible to evaluate the results of the test. The Global Deterioration Scale (GDS) measuring stages of cognitive deterioration due to Alzheimer's disease shows important differences among the participants. As already indicated in the review, Stage 3 represents a light deterioration, Stage 4 a moderate, Stage 5 a severe, and, finally, Stage 6 a very severe cognitive deterioration. It should be noted that no direct correspondence should be assumed between the scores of the MMS and the GDS.

THE SETTING

The nursing home, under the auspices of the provincial government of Quebec, was chosen for possession of characteristics representative of most long-term care institutions intended for patients in more or less advanced stages of dementia. Government policies in Quebec are aimed at keeping Alzheimer's patients in their home environment as long as possible before transferring them to a nursing home, which accounts for the relatively old population in nursing homes and the degree of cognitive deterioration. The chosen nursing home is situated in Montreal. It lodges 125 patients on four floors and contains a number of communal and social functions at the ground floor. The nursing home also offers the services of a day-center. A typical floor plan and the layout of the ground floor are shown in Figure 1.

PROCEDURE FOR THE INTERVIEW

The interviews were based on a questionnaire and were run in a semistructured way so as to allow for a full and in-depth response. The major items covered were the perception the staff had concerning the autonomy of the patients and the center's policies in that respect; a profile of the wayfinding abilities of the patients and the center's policies with respect to their free movement; the major problems encountered with respect to the

TABLE 1
Sample Characteristics for the 6 Alzheimer Patients
Participating in the Wayfinding Experiment

Participant	Age	Sex	MMS	GDS
1	88	F	15	4
2	94	F	15	5
3	92	F	15	5
4	76	F	22	3
5	91	F	—	6
6	82	F	12	5

NOTE: MMS = Mini Mental State (Folstein, Folstein, & McHugh, 1975); GDS = Global Deterioration Scale (Reisberg, 1985).

general circulation of the patients, as well as shortcomings concerning the elevators, signage, and place identification; the policies of restricting the movement of the patients; the role and importance of the nursing station; and security. The interviews with the 10 staff members were recorded and generally lasted a bit longer than an hour.

PROCEDURE FOR THE WAYFINDING EXPERIENCE

Based on the interview data, four destinations were chosen in the nursing home for the wayfinding experience. The tasks for each participant were to go

1. from their rooms to the living room situated on the same floor;
2. from the living room to the cafeteria, situated at the ground floor and requiring the use of the elevators;
3. from the cafeteria to the recreation room also situated at the ground floor; and
4. from the recreation room back to their own rooms requiring again the use of the elevators.

The tasks were designed to incorporate typical, ecologically valid wayfinding situations. Task 1 was the most frequent for the patients, taking place on their "home ground," their most familiar environment. Task 3, in contrast, involves a less common route in an environment that is least known to the severely affected resident. Both Tasks 2 and 4 are made more complex because the destination is located on a different floor and requires the use of the elevators.

An observer walked with the participant and assured that the participant verbalized her thought process. To keep the verbalization going, the observer inquired about the decision-making process in plain language. Among the
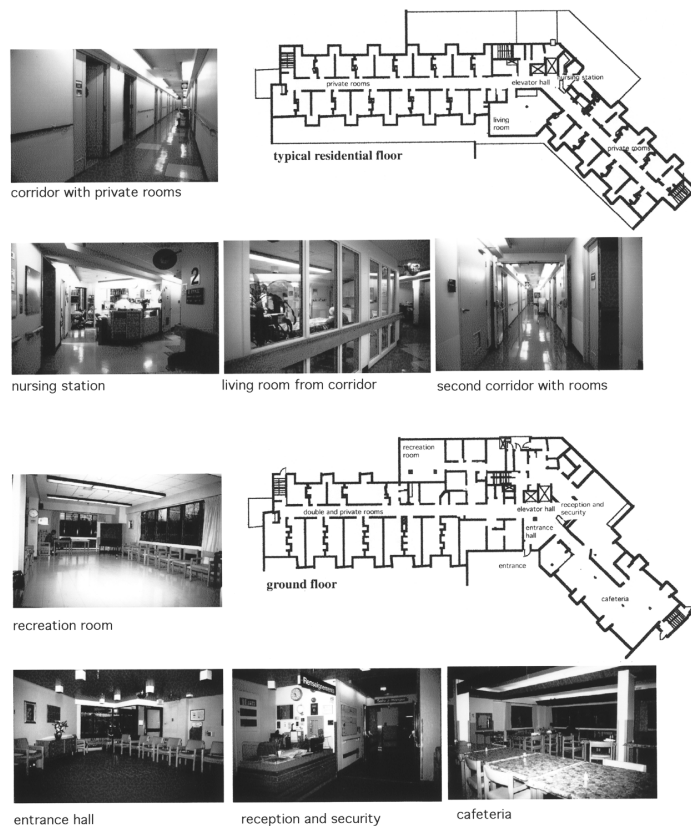
Figure 1: Typical Residential Floor Plan and Layout of the Ground Floor

key questions were the following: What are we doing now? What are you looking for? And, Where are we going? When the participant made a wayfinding decision, the observer explored the reason for the decision. For example, the observer would ask, "Why are we going down this corridor?" This technique has been used in previous wayfinding experiments with Alzheimer patients (Passini et al., 1998). In case of an insurmountable difficulty, such as total disorientation or prolonged searching, the observer intervened by providing the required information or showing the way. The participants were instructed not to ask other people for information. Each of the four tasks was treated separately and a memory aid was given in the form of a little piece of cardboard with the name of the destination on it. A second observer followed and noted on a floor plan behavioral particularities such as hesitations,

exploratory behaviors, and so on, in their environmental context. The conversation between the first observer and the participant was recorded on a small tape recorder.

RESULTS, DISCUSSION, AND DESIGN IMPLICATIONS

The results are presented under five headings: (a) mobility profile of the patients, (b) architectural features affecting spatial orientation and wayfinding, (c) graphic and verbal information for wayfinding, (d) particular reactions to design features, and (e) policies of the center affecting mobility.

The data obtained from the interview and the wayfinding experiment are presented separately but under the same heading, which brings out the concordance or the contradiction between the view of the staff and the patients. Each heading concludes with a short discussion and suggestions for possible design interventions.

MOBILITY PROFILE OF THE PATIENTS

By mobility profile we understand the range of destinations a resident is able to reach. A distinction is made between autonomous and assisted wayfinding. Mobility, understood as the reaching of chosen destinations, depends on the wayfinding abilities of the patients but also on the policies of the institution. Purposeful movement might be encouraged or restricted and discouraged by staff members.

Interview data. The interview data reflects how the staff of the center perceives the degree of mobility of their patients. We asked the staff if the patients they were in charge of could perform wayfinding tasks comparable to those of the wayfinding experiment. The assessment by the staff varied greatly. The variations were partly due to their involvement with different populations of the center, but they were also due to perceptual differences. Excluding the special closed floor for very advanced cases, it was thought that between half and a quarter of the patients are able to get around on their home floor without aid. It has been noted, though, that members of the staff take most patients who leave the floor of their living quarters to their destination.

New patients seem to have more difficulties getting around. Problems are evident when having to find their rooms and when having to distinguish one wing of the layout from the other. They may then simply walk to the end of

the corridor and may have to be redirected by the staff. Learning seems to be slow and the adaptation to the new settings may take months.

When lost, patients exhibit a variety of behaviors expressing anxiety, confusion, and even panic. Some will resort to mutism whereas others will talk nonstop. Some will walk excessively, incapable of saying that they are lost. It appears that these wayfinding difficulties vary within a typical day. They seem to be accentuated in the late afternoon ("sundowning"). Aimless wandering also increases during this period. Various reasons have been suggested. Some respondents think the increase in wayfinding difficulties is due to an increase in the center's activities during that period or changes of staff teams; others attribute the increase of difficulties to a general state of tiredness toward the end of a day.

Wayfinding data. Table 2 summarizes the results of the wayfinding experience. Small variations in the walking scenario had to be introduced. If, at the beginning of the experiment, the participant was in the living room, an additional task of going to her own room was introduced (coded as 1ad). The scores in the table reflect a measure of wayfinding performance expressed in levels of autonomy (see Table 2 note).

The table shows that familiarity with the setting is not a major factor accounting for the error-free completion of the tasks. One might have expected that wayfinding on the floor of their personal rooms and living room, where the patients spend most of their time and move about more or less independently, would be far superior to the tasks situated on other floors. This observation is even more meaningful if one considers that most of the patients take their meals in the living room situated on their home floor, and that if they participate in programmed activities of the center most of them are taken to their destination by the staff. The task of returning to their personal rooms (1ad and 4c) are among the least successful, with the exception of the use of the elevators. Only 1 person (Participant 4) is consistently able to find her room; 3 participants have to depend fully on the investigator. Going from their personal rooms to the living room seems to be easier: 4 people complete it without difficulties. The task of going from the elevator to the cafeteria, although it is set in a relatively complex environment, obtains a relatively high score. Going from the cafeteria to the recreation room is an unusual task, and a difficult one, because the route follows a series of corridors and because the destination is not visible from the main circulation (see Figure 1).

The table also indicates strong differences between the performance of the participants. Participant 4 has a perfect score completing all the tasks independently. A comparison with Table 1 shows that she also scores high on the

TABLE 2
Wayfinding Performance of the 6 Alzheimer's Patients

Wayfinding Task	Participant					
	1	2	3	4	5	6
1ad—from living room to personal room	—	—	0	3	0	0
1—from personal room to living room	3	3	1	3	3	0
2a—from living room to elevator hall	0	3	0	3	3	0
2b—elevator	1	0	0	3	0	0
2c—from elevator to cafeteria	0	3	3	3	0	1
3—from cafeteria to recreation room	0	—	3	3	1	—
4a—from recreation room to elevator hall	0	0	1	3	3	1
4b—elevator	3	0	0	3	0	0
4c—from elevator to personal room	2	0	0	3	0	3

NOTE: 3 = independent (the person reaches destination directly, without help); 2 = independent with error (the person reaches destination without help but made a mistake, which was corrected by the participant him- or herself); 1 = partial aid (the person needs the help of the observer in the form of cues or wayfinding decisions); 0 = total aid (the person is essentially taken to the destination by the observer).

MMS indicating relatively high intellectual abilities and low in the GDS, classifying her at the early stage of the disease. Participant 6, at the other extreme of wayfinding performance, scores low on the MMS and high on the GDS. The other 4 participants have similar total scores. Participant 3, although a poor wayfinder in her own living quarters, does relatively well in the more complex situations on the ground floor.

Discussion and design implications. The data shows that even patients with relatively severe cognitive deterioration are capable of solving some wayfinding problems in their familiar and semifamiliar environment. The diversity in succeeding certain tasks while failing others of about equal complexity (for example, to go to the living room and to go to their personal rooms) shows the importance of characteristics of the physical environment. It suggests that supportive wayfinding features can be incorporated in the design of therapeutic care units.

The poor performances when going to their own rooms and the relatively good performances on the ground floor (even if the latter is only semifamiliar, only rarely explored by themselves, and more complex) points to an important aspect of wayfinding design. Monotony in architectural composition leading to repetitive environments, even if they are simple, render wayfinding more difficult. Labyrinths are disorienting because of their

repeated sameness. The Alzheimer's patient is probably still able to deal with an articulate environment as long as the tasks keep within the boundaries of their abilities.

The staff of the institution tend to take the patients to their destinations if they go outside their living quarters. This might be helpful and securing to the patients but it also leads the patients not to use their remaining wayfinding abilities. The danger to an overly protective approach is to cause a possible atrophy of potential wayfinding abilities and a reduction of the patients' sense of achievement and autonomy.

ARCHITECTURAL FEATURES AFFECTING SPATIAL ORIENTATION AND WAYFINDING

Architectural features affecting wayfinding can be grouped into two major parts: (a) features related to the spatial organization of the setting and (b) features providing the wayfinding person with information necessary for the decision-making process. The spatial organization of a setting (its layout) is reflected in the circulation system, whereas the most important architectural information for wayfinding in Alzheimer's patients comprise the identification of reference points and places.

Characteristics of the Circulation

Interview data. The layout of a typical residential floor shows a certain symmetry when seen from the elevator lobby. Some patients mix up the two sides and tend to look for their rooms in the wrong corridor. This confusion is particularly evident with new patients.

The length and narrowness of the corridors is a major critique by the staff members. Maintenance equipment often encumbers the space, making circulation difficult and has led to disorientation and anxiety. The difficulties are aggravated when wheelchairs are in use.

The elevators are major causes of wayfinding difficulties. Many patients have forgotten how to use them. They do not press the right command or do not give any commands at all. The waiting time to get into the elevators often exceeds their attention capacities. Getting in and out of the elevators has to happen quickly, otherwise the doors close. The difficulty of recognizing the floor to get out renders the use of the elevators inaccessible to most patients. A certain nervousness has also been observed when patients have to use the elevators, even if the staff accompanies them.

Wayfinding data. The difficulty of choosing the right corridor when getting out of the elevators or the living room is confirmed by the wayfinding data. Four participants, at one time or another, confused the two wings.

Encumbered corridors distracted some participants. One person even chose an opposite corridor when the path to his room was obstructed.

The use of the elevator has been shown to be the most difficult part of the wayfinding task. Only 1 participant, who was in every regard successful in solving our wayfinding problems, was able to cope with the elevators (Participant 4). Four participants refused even to try to press the command buttons. They also had difficulties identifying the appropriate floor, relying fully on the observer. It has to be noted that most patients are not in the habit of using the elevators by themselves but rely on staff members for this task. This makes it rather difficult to assess their real potential.

Two participants felt that they had left their home turf when using the elevators. They insisted on checking their clothes before "going out."

Discussion and design implications. The ability to cognize the spatial organization of a building has been shown to be affected already at the early stages of Alzheimer's disease (Passini, Rainville, Marchand, Joanette, & Lepage, 1997). One of our participants in the present study was able to correctly identify all areas of the building she was asked to find, which must be seen as an exceptional case. One would not expect a typical patient at an advanced stage of the disease to cognitively map a building or even a particular route. Similarly, we indicated in a previous paper that the capacity of decision making is reduced to decisions based on immediate and visually accessible information. Complex structured decision plans involving anticipated information are out of the question. The patient even at a medium state of the disease will only be able to function from one decision point to the next in a sequential and linear order (Passini et al., 1998).

The data show that even though the circulation routes ought to be simple, they must not be monotonous. The setting, we suggest, should be designed so that it offers visual access to its major spaces and functions, so that patients who have lost their cognitive mapping abilities can obtain the information to make their wayfinding decisions. The corridors should allow for spaces to park maintenance equipment without interfering with the normal circulation in the unit.

The data clearly shows that the elevators provoke a rupture in wayfinding performance for most of the patients. Its use leads to apprehension and to an inability to reach many desired destinations. Ideally, nursing homes for

Alzheimer's patients should not involve elevators. This recommendation appears difficult to apply considering impinging factors such as urban density and financial constraints. If a nursing home has to be housed on different levels requiring an elevator, each floor should be autonomous in terms of all basic functions including recreation and social interaction. In times of special activities on other floors, an employee might take over the operation of the elevators and help the patients to get in and out at the appropriate place. This might also in time reduce anxiety toward the use of the elevators.

Reference Points

Reference points are distinctive elements in the environment that are remembered or recognized. They have a major function in wayfinding and spatial orientation. They act as anchor points in localizing nearby spaces and are important in remembering wayfinding decisions along a given path.

Interview data. The staff identified a number of features on the residential floor that, according to them, were reference points for the patients. They are composed of spaces with distinct functions such as the nursing station, the living room, and the elevator lobby. The presence of a clock was also mentioned as an important reference point. It was agreed that the corridors to the rooms lack any reference points. Reference points on the ground floor include the entrance hall, the cafeteria, the security post, a water fountain, and many others.

Wayfinding data. It is not always possible to infer from the wayfinding data what element is perceived as being a reference point. Nevertheless, some do stand out. The security post was referred to by most participants and so were the nursing stations at the residential levels. The doors of the elevators were also of considerable importance. No participant mentioned the clock that seemed so important to the staff.

Discussion and design implication. An articulate and differentiated environment provides the basis for people to create reference points. The characteristics of a reference point are essentially to be distinctive from other elements by form, by function, and if possible also by meaning. The clock in the above example is a good illustration. It has little or no meaning to the resident but is highly important to the staff. An ideal reference point combines form, function, and meaning.

Reference points are especially important for Alzheimer's patients who tend to operate on a sequential basis from one decision point (reference point) to the next. This, in addition to deficient spatial cognition, is probably the explanation of the poor wayfinding performance in the uniform corridor leading to the rooms and the relatively good performance on the ground floor, which contains a number of different functions and expressions. An architecturally rich and articulate environment is helpful to all, but appears to be particularly important to the wayfinding of Alzheimer's patients.

Recognizing Places

Places can be recognized by their function and furniture as well as the interior design and decorative features associated with that function. The graphic contribution to place recognition is covered in the next section.

Interview data. It is generally agreed that identifying and recognizing a place represents a major challenge to the advanced Alzheimer's patient. On the closed floor (housing the most advanced cases) more than two thirds cannot recognize or have difficulties recognizing the doors to their own rooms. Between 20% and 25% of the other patients have regular difficulties in doing so. The corridor leading to the rooms is uniform, without distinctive features that might serve as a reference point. Although the doors are painted in different colors between floors, they are identical on a given floor. Once patients enter their rooms they tend to recognize them as their own, thanks to personal items. Most staff members agree that more could be done to personalize the patients' own living spaces by having them choose decorative elements such as curtains, bed covers, and even to allow them to include some of their own furniture.

The other major room used by the patients is the living room, which is centrally located on each floor. Over the years the population of the center has changed, the average person now being more severely affected. Rather than using the cafeteria at the ground floor, the living room has also become a dining room. This double function of the living room, requiring daily rearrangements of the furniture, has created difficulties in finding a proper expression of the room's function. It has also been suggested that the daily changes create a feeling of instability and insecurity with patients. The living room is provided with a glass bay window giving visual access from the main circulation. It is considered a main feature in facilitating the recognition of its function as a place for dining and social gathering. The staff observed that some

patients stopped and were waiting in front of the glass bay, incapable of finding the door that was just a few meters further on.

The rooms on the ground floor differ greatly in their ease of recognition by the patients. Whereas the cafeteria is easily seen from the elevators and the entrance hall and clearly expresses its function through its size, furniture, and interior design, the recreation room is the most difficult place to see, find, and recognize. The entrance hall, also used as a place for social gatherings, is a good example of how a place can be made distinctive and recognizable through its architecture, its relation to the exterior, special floor covering, and seating arrangements.

Each floor is treated with a different color to facilitate recognition. The color is repeated on doors and door frames. However, it was observed that the colors used were not sufficiently strong to be distinguished.

Wayfinding data. Much of the wayfinding data confirms the information obtained in the interview. Difficulty in finding their own rooms was manifest in 4 of the 6 participants. They tended to identify the correct side of the corridor but could not distinguish between the doors, even if the name and sometimes the photo of the occupant were shown on the door. The doors to the rooms were grouped in pairs. A participant could identify that her door was the second of the pair but could not distinguish between the pairs. She therefore opened every second door. If the participants entered a wrong room they showed signs of anxiety. They were all relieved when they found themselves in their own rooms and recognized their personal items. The bed cover seemed to be a particularly important element of appropriation.

With the exception of 1 participant, all were able to go to and recognize the central living room. The cafeteria at the ground floor was also easily recognized, as was the entrance hall. The recreation room, as already indicated, is situated off the main circulation path. It was predictably difficult to find, although 2 participants reached the place without any hesitations. They had retained a glass panel as a reference point identifying the corridor leading to the recreation room.

The hall on each floor was clearly identified by the nursing station and the living room, and easily recognized by the patients. Recognition of the appropriate floor from the elevator, on the other hand, was difficult for most of the participants. Some of the features facilitating recognition were the furniture and the floor level painted in large numbers on the wall. Nobody used or mentioned the color code for the floors.

Discussion and design implications. The personal room is a privileged space for the patients where privacy can be found. It ought to reflect the

person's values as much as possible. Objects that signify these values also facilitate the cognitive process of recognition and identification. The personal rooms in the studied nursing home were rather similar, with identical color and similar furnishing, which does not help the patients to distinguish their own rooms from others.

Direct visual access to common rooms facilitates recognition and might even lead people to use a place they might otherwise not have remembered.

It is no doubt easier to recognize a place when its function is stable. Basic living functions such as eating and relaxing should have a permanent locale or at least a permanent section in a locale and permanent furniture arrangements. Recreation rooms on the other hand can probably still remain multifunctional.

GRAPHIC AND VERBAL INFORMATION FOR WAYFINDING

This section refers to signage and any other verbal or iconic information used in facilitating wayfinding. It is complementary to the information provided by architecture and features of interior design.

Signage

The term *signage* comprises all written and iconic information displayed in the setting.

Interview data. It is generally agreed that the signage was conceived for mentally alert users who are able to read and that it does not respond to the cognitive functioning of an Alzheimer's patient. Even the positioning of the signs is ill adapted. The elderly, and Alzheimer's patients in particular, tend to look at the ground. Signs, as they stand, are not in their visual field. It was also mentioned that competing information displays should be reduced. Plans, it is generally agreed, are not really useful for the patients as most of them have lost the capacity to read them. The floor numbers are indicated in large numbers on the wall outside the elevators; a smaller sign points to the rooms by room numbers. The floor number outside the elevators seems to be used by some patients, although according to some staff members they should be emphasized even more. Some suggest a greater use of pictograms, which attract attention and might be understood even if reading is no longer possible. The signage in the elevators is generally considered insufficient.

A number, the name of the resident, and a provision to insert a photo identify each room. The name on the door is seen as being useful for those who

can still read. Some suggest that the size of the sign is too small. The photo is also seen as being helpful if the person can recognize him or herself. Photos taken in the past tend to be more easily recognized by the patients. It has also been suggested that the numbering is intended for visitors rather than patients, as few of the latter are able to retain their room numbers.

Wayfinding data. Most of the information provided was presented in written form through signs. This information was used occasionally to confirm the identity of a place. The hairdresser is a rare place indicated by a handmade pictogram showing a pair of scissors. Participant 6 was able to reach the hairdresser although otherwise incapable of reaching destinations other than her own room. None of the participants were aware of the color code used to distinguish the floors of the center.

Only Participant 4 was able to recall her room number and used it to get there. The other participant who was able to find her room did so by remembering its spatial position with respect to the hall (reference point) and by checking the nametag.

Some participants tried to read all the information available without being able to discriminate between relevant and irrelevant signs. The situation was accentuated in the elevators where the key command buttons are mixed with nonessential aspects of elevator use. Even the presence of an ashtray interfered with information processing of a participant.

It was also observed that the security agent at the ground floor serves as a major source of information.

Discussion and design implications. It can be argued that signs are less important in familiar environments and that in a nursing home they mainly serve visitors. This might not be quite so for Alzheimer's patients. Signs may help to recognize places when architectural and interior design features are not sufficient in passing the message. They may provide directional information to remind the patients of where facilities are located and of how to return to their points of origin. In rooms that provide protection and privacy, visual access through glass doors is not feasible and signs have to communicate the essential information. Little is known about the use of picto- grams for Alzheimer's patients rather than written signs, and an exploration in that field might certainly be worthwhile.

The difficulty of distinguishing relevant from irrelevant information has also been noted in previous work (Passini et al., 1998). It is suggested that on circulation routes, only the most important wayfinding information be present. All other announcements and directives ought to be presented elsewhere.

Common rooms or social gathering points can be enriched by these messages without interfering with wayfinding.

The Naming of Rooms

In this section we are looking at the names used when designating places in the center.

Interview data. Over the years, some rooms have changed their function. The living room located on each floor is now also used as a dining room. The room is still referred to as the *living room* (*salon* in French), which leads to a certain ambiguity. This ambiguity is increased by the fact that the cafeteria at the ground floor (*salle à manger*) is now used mainly for special events such as social games and festive occasions. Certain rooms have also changed their name without even a change of function. The recreation room at the ground floor was called *animathèque*, then *common room*, and, finally, *recreation room*. The interview data shows that all three names are still used by the staff and correspond to the period when they started to work at the home. To confuse things still further, there is a second recreation room in the basement.

Wayfinding data. The confusion also manifested itself in the wayfinding experiment when participants had difficulties understanding which destination was meant by *cafeteria*. They were always eating in the living room of their floor and only went to the so-called *cafeteria* for special events such as bingo sessions, Christmas, and other major celebrations. The situation was even confusing for the experimenter when communicating the wayfinding tasks to the participants and the staff.

Discussion and design implications. The name given to rooms must relate to a function. It has to be consistent among the patients and the staff, to concord with the vocabulary used on signs and other wayfinding supports, and ought to reflect the cultural particularities of the patients as much as possible.

PARTICULAR REACTIONS TO DESIGN FEATURES

The reaction of the Alzheimer's patients concerned mainly the surface treatment and patterns on the floor.

Interview data. The monotony of the floor cover was a point of critique, and it was suggested that reference points could be introduced on the floor to

facilitate orientation. On the other hand, it was noted that the tile pattern disturbs the patients who tend to watch the floor when they walk. They tend to follow the lines created by the tiles. Sometimes they take them for steps or even holes. Some patients stride carefully over a small dark line separating the corridor from their rooms. The metal board in the elevators on which the doors run is known to be a true obstacle for some patients. The effect of floor patterns is surprisingly strong. Black floor bands have in fact been used by the staff to reduce access to certain places. Another point of contention is the treatment of the floor surface. The shiny finish of the linoleum is seen to reflect too much light and is causing anxiety for some.

Wayfinding data. Two participants were reacting to the floor surface. One had the feeling she was walking on her shadow and had to overstep perceived obstacles. The other participant thought she had to stride over the metal strip of the elevator.

Discussion and design implications. The reactions are particular to individuals but nonetheless real. It seems that dark patterns should be avoided as well as any decisive separation of one area from the other. However, the major lesson from these observations is that design ideas concerning decorative elements must be pretested. It is indeed very difficult to foresee the emotional and interpretive reaction of an Alzheimer's patient.

THE POLICIES OF THE CENTER AFFECTING MOBILITY

Wayfinding performance, and the resulting degree of spatial mobility, is dependent on the patients' cognitive abilities and the nature of the physical and the human environment. An attitude of encouragement by the staff is all-important in prolonging the patients' autonomy and its prerequisite, mobility. This section concerns the care policies of the center that impinge on mobility.

Interview data. The policies of a center regarding the patients' autonomy cannot be obtained by a direct question. No institution will readily admit that the autonomy of their patients is not important. The true policy, though, is reflected in many daily activities. One of the most insightful activities is dressing. Many nuances in not assisting, assisting, and taking over dressing are observable. To assess the staff's attitude to the importance of the patients' autonomy, they were confronted with the hypothetical situations of a resident having some difficulties getting dressed. The responses indicate that if the resident takes too much time, most of the staff will intervene and dress the

person completely. Two reasons are being given to justify the intervention; first, to save time, and second, to reduce anxiety. Exceptionally, they may give a partial aid, such as getting out the clothes and checking later on the patient's progress. If the resident has difficulties choosing what to wear help can be partial, but more often the patient gets fully dressed by the staff.

The nursing station takes up a central part of the floor and is located to provide visual access to both corridors and to the living room. The interview shows that the location is seen as encouraging social contact and providing a sense of security. The patients tend to stay in the vicinity of the station to chat with the nursing staff, which may cause some circulation difficulties. The surveillance aspect is also considered important in the location of the station. The only rooms that are not surveyed are the private rooms of the patients. Some go as far as to suggest that the doors to the rooms be kept open at all times.

Various restrictions in the movement of the patients have been mentioned. Bracelets stopping patients from leaving a given floor or the building are used for those who have tendencies of wandering and of walking out of the residence. Alarm systems are used on various doors. Camouflage made of screens is used on fire exit doors. Psychological circulation restrictions are also used in the form of black bands applied to the floor surface in front of the fire escape stairs.

Discussion and recommendation. Design for wayfinding only makes sense if the patients are encouraged to use the setting as intended, that is, by being as autonomous as possible. The desire to encourage maximal autonomy of the patients is confronted by two major constraints: efficiency and security. It is often more time consuming to assist patients in letting them do things by themselves than in doing things for them. Although concern with efficiency is a necessary evil in understaffed settings, the question of security versus autonomy is more nuanced. The security of patients in a nursing home is essential, but the quest for security at all costs can easily lead to excessive control. Some centers do have an agreement with family members, or clearly stated policies addressing the question of security and restrictions. Such agreements might also contextualize the degree of responsibility of the institution.

The positioning of the nursing station has important symbolic meanings. The message given by a nursing home is not the same if it is the controlling nursing station that occupies the center or if it is a space used for recreation and social activities. Many nursing homes are still inspired by hospital layouts with central medical and supervisory facilities rather than by a residential model. From this point of view the suggestion would be to place nursing

stations as discretely as possible while still allowing for the supervision of essential points such as the entrance to the floor. We have also seen that the nursing station is a major reference point for the patients; thus, if it is visible it will facilitate wayfinding. The open question is if a social central facility, such as a recreation room, would take on the function of a reference point.

CONCLUSION

A therapeutic environment for Alzheimer's patients enhances the quality of life of its patients and the maintenance of optimal autonomy as long as possible. The basic human needs, be they physical, psychological, or social, require the person to reach destinations. This activity has been described as mobility. Wayfinding is a major prerequisite of mobility and, thus, of independence and personal autonomy. Three major factors affect the mobility of an Alzheimer's patient in the context of a nursing home: (a) the person's psychological and mental state, (b) the physical environment, and (c) the caregiving environment.

The person's psychological and mental state determines the motivation and the cognitive abilities to face and solve wayfinding problems. Alzheimer's patients at an advanced phase have limited abilities. Spatial cognition at the large-scale environments, also referred to as cognitive mapping, is generally deficient, nor can they plan complex journeys. It is suggested that their wayfinding strategy is environmentally dependent, making only small demands on memory and spatial understanding. Some of this memory and spatial understanding is still operational, but memory often is based on recognition when confronted with a particular scene, and spatial understanding is limited to small-scaled spatial relations such as knowing on which side of the corridor a room is located.

The physical environment interacts with people and to a certain extent determines their wayfinding success. As a person's mental and also physical abilities decline, the importance of the physical environment increases. The physical environment, through its disposition of spaces and functions and through the design of the circulation system, determines the wayfinding problems future users have to solve. With respect to Alzheimer's, wayfinding problems should be simplified by creating small-scaled settings with simple but not monotonous circulation routes that allow for a variety of experiences, including wandering. The idea of wandering loops is interesting as it gives also a public character to the circulation.

The physical environment not only creates the wayfinding problems people have to solve but it can also provide information to solve these problems. That information can be of an architectural nature including features of interior design and of a graphic nature. Information should be presented by different means to allow for personal preferences and redundancy. Given the patients' sequential style of wayfinding, information to allow for recognition of places and reference points is particularly important. Direct visual access to form and function is to be encouraged whenever possible. Attention has to be paid to avoid distracting patients by nonrelevant information displays. The environment has to speak a language that the user, the Alzheimer's patient, can understand.

The caregiving environment, through its policies and individual attitudes, encourages certain behaviors and discourages others. The notion of therapeutic environments and quality of life depends on a humanistic approach to care. Although nobody is against a humanistic approach, concerns with efficiency and security often lead to restrictive practices. In a similar manner, it is often considered safer to keep patients from wandering, going out to an open space, and getting involved in activities that are not organized and overseen. Security is a complex issue also involving responsibilities toward the patient, other patients, and family. Still, if quality of life is taken seriously, the grip of efficiency and security will have to be loosened.

REFERENCES

Adam, E. (1996). La personne âgée et son besoin de se sentir utile [The elderly person and the need for being useful]. In S. Lauzon and E. Adam (Eds.), *La personne âgée et ses besoins* (pp. 11-58), Montreal, Canada: Édition du renouveau pédagogique.

Baltes, P. B., & Baltes, M. M. (1990). *Successful aging: Perspectives from the behavioral sciences*. New York: Cambridge University Press.

Barbizet, J. (1970). *Pathologie de la mémoire* [Pathology of Memory]. Paris: Presses Universitaires de France.

Bizzini, L. (1985). *D'une nouvelle approche séméiologique en neuropsychologie: Application à l'orientation spatiale* [A new semiotic approach in neuro-psychology: An application to spatial orientation]. Thèse de doctorat, Université de Genève.

Boehme, M. (1973). *La détérioration dans la démence sénile* [Deterioration in senile dementia]. Neuchatel, France: Delachaux et Niestlé.

Calkins, M. P. (1988). *Designing for dementia: Planning environments for the elderly and the confused*. Owings Mills, MA: National Health.

Chenoweth, B., & Spencer, B. (1986). Dementia: The experience of family caregivers. *The Gerontologist*, *26*, 267-272.

Cohen, U., & Weisman, G. D. (1991). *Holding on to home*. Baltimore: John Hopkins University Press.

Cohen, U., Weisman, G. D., Ray, K., Steiner, J., Rand, J., & Toyne, R. (1988). *Environments for people with dementia: Design guide*. Washington, DC: Health Facilities Research Program, AIA/ACSA Council on Architectural Research.

Coons, D. H. (1991). The therapeutic milieu: Concepts and criteria. In D. H. Coons (Ed.), *Specialized dementia care*. Baltimore: Johns Hopkins University Press.

Coons, D. H., & Mace, N. L. (1996). *Quality of life in long-term care*. New York: The Haworth Press.

Cummings, J. L., & Benson, D. F. (1992). *Dementia: A clinical approach*. Boston: Butterworth-Heinemann.

de Ajuriaguerra, J., Rey-Bellet, N., Muller, M., & Tissot, R. (1964). A propos de quelques problèmes posés par le déficit opératoire de vieillards atteints de démence dégénérative en début d'évolution [Some problems caused by operational deficits in elderly people affected by early degenerative dementia]. *Cortex*, *1*, 102-132, 232-256.

Dickinson, J., McLain Kark, J., & Marshall-Baker, A. (1995). The effects of visual barriers on existing behavior in a dementia care unit. *Gerontologist*, *35*, 127-130.

Downs, R., & Stea, D. (1977). *Maps in Mind*. New York: Harper and Row.

Gärling, T., Böök, A., & Lindberg, E. (1986) Spatial orientation and wayfinding in the designed environment. J*ournal of Architectural adn Planning Research*, *3*, 55-64.

Gärling, T., & Golledge, R. G. (1989). Environmental perception and cognition. In E. H. Zube & G. T. Moore (Eds.), *Advances in environment, behavior, and cognition* (Vol. 2, chapter 7). New York: Plenium.

Gutman, G. M. (1989). *Dementia patients in institutions: A review of recommendations and research concerning their design, staffing and programming needs*. Burnaby, BC, Canada: The Gerontology Research Center, Simon Frazer University.

Hall, G. R., Kirschling, M. V., & Todd, S. (1986). Sheltered freedom; an Alzheimer's unit. *Geriatric Nursing*, *7*, 132-137.

Hiatt, L. G. (1986). Environmental design and mentally impaired older people. In H. J. Altman (Ed.), *Alzheimer's disease and dementia: Problems, prospects and perspectives* (pp. 309-320). New York: Plenum.

Kaplan, R. (1976). Wayfinding in the natural environment. In G. Moore & R. Golledge (Eds.), *Environment knowing*. Stroudsburg, PA: Dowden, Hutchinson & Ross.

Kitwood, T. (1995). *The new culture of dementia care*. Bradford: Hawker.

Kociol, L., & Schiff, M. (1989). *Alzheimer: A Canadian family resource guide*. Toronto, Canada: McGraw-Hill.

Lawton, M. P. (1982). Competence, environment press and the adaptation of older people. In M. P. Lawton, P. G. Windley, & T. O. Byerts (Eds), *Aging and the environment: Theoretical approaches* (pp. 33-59). New York: Springer.

Liu, L., Gauthier, L., & Gauthier, S. (1991). Spatial disorientation in persons with early senile dementia of the Alzheimer type. *The American Journal of Occupational Therapy*, *451*, 67-74.

McDowell, I. (1994). Canadian study of health and aging: Study methods and prevalence of dementia. *Canadian Medical Association Journal*, *150*, 899-913.

McGrowder Lin, P., & Bhatt, H. (1988). A wanderer's lounge program for nursing home residents with Alzheimer's disease. *Gerontologist*, *28*, 607-609.

Mietkiewicz, M-C. (1981). Pensée opératoire, détérioration mentale et démences du grand âge [Operational thinking, mental deterioration, and dementia in advanced age]. Paris: Colson.

Montambault, J., & Bergman, H. (1997). Hébergement [Residences (housing)]. In M. Arcand & R. Hébert (Eds.), *Précis pratique de gériatrie*. Saint-Hyacinthe, France: Édisem.

Müller, C., & Wertheimer, J. (1981). *Psychogériatrie* [Psychogeriatrics]. Paris: Masson.

Namazi, K. H., Rosner, T. T., & Rechlin, L. (1991). Long term memory cuing to reduce disorientation in Alzheimer's disease patients in special care unit. *The American Journal of Alzheimer's Care and Related Disorders and Research*, *6*, 10-17.

Passini, R. (1977). *Wayfinding: A study of spatial problem solving*. Unpublished doctoral dissertation, Pennsylvania State University, Philadelphia.

Passini, R. (1984). *Wayfinding in architecture*. New York: Van Nostrand Reinhold.

Passini, R. (1998). Wayfinding: Backbone of graphic support systems. In H.J.G. Zwaga, T. Boersema, & H.C.M. Hoonhout, (Eds.), *Visual information for everyday use: Design and research perspectives* (pp. 241-256). London: Taylor and Francis.

Passini, R., Joanette, Y., Rainville, C., & Marchand, N. (1995). Dementia of the Alzheimer type and spatial disorientation. *Brain and Cognition*, *28*, 109.

Passini, R., Joanette, Y., Rainville, C., & Marchand, N. (1998). Wayfinding in dementia: Some research finding and a new look at design. *Journal of Architecture and Planning Research*, *15*, 133-151.

Passini, R., Rainville, C., Joanette, Y., & Marchand, N. (1995). Wayfinding in dementia of the Alzheimer type: Planning abilities. *Journal of Clinical and Experimental Neuro Psychology*, *17*, 820-832.

Passini, R., Rainville, C., Marchand, N., Joanette, Y., & Lepage, Y. (1997). La déterioration des operations spatio-cognitives dans la maladie d'Alzheimer [The deterioration of spatio-cognitive operations in Alzheimer's disease]. *Revue de Neuropsychologie*, *7*, 247-279.

Puel, M., Demonet, J-F., Ousset, P-J., & Rascol, O. (1991). La maladie d'Alzheimer [Alzheimer's disease]. In M. Habib, Y. Joanette, & M. Puel (Eds.), Démences et syndromes démentiels: approche neuropsychologique (pp 45-60). Paris: Masson.

Rainville, C. (1992). Les troubles de la représentation anticipatrice et de la représentation spatiale dans la maladie d'Alzheimer [Difficulties in anticipatory and spatial representation in dementia of the Alzheimer's type]. Unpublished doctoral dissertation, University of Montréal, Montréal, Canada.

Rainville, C., Passini, R., & Joanette, Y. (1994). Les troubles de l'orientation dans l'espace dans la démence de type Alzheimer [Spatial orientation difficulties in dementia of Alzheimer's type]. *Revue de Neuropsychologie*, *4*,3-45.

Reisberg, B. (1985). Le vieillissement du cerveau [Aging of the brain]. *Gerontologica Biomedica Acta*, *1*, 63-102.

Reisberg, B., Ferris, S., & Crook, T. (1982). Signs, symptoms and course of age-associated cognitive decline. In S. Corkin, K. L. Davis, J. H. Growdon, E. Usdin, & R. J. Wurtman (Eds.), *Aging: Vol. 19. Alzheimer's disease: a report of progress* (pp. 177-182). New York: Raven Press.

Reisberg, B., Ferris, S. H., Franssen, E., Kluger, A., & Borenstein, J. (1986). Age associated memory impairment: the clinical syndrome. *Developmental Neuropsychology*, *2*, 401-412.

Richard, J., Bizzini, L., Arrazola, L., & Palas, C. (1981). De l'actualisation des structures cognitives dans les démences à (ou à prédominance de) plaques séniles (PS) et dégénérescences neurofibrillaires (DNF) [Cognitive structures in dementia with a predominance of senile plaques and neuro fibre regeneration]. *Médecine et Hygiène*, *39*, 4027-4036.

Richard, J., Bizzini, L., & Boghetti, T. (1979). De la réalisation d'itinéraires dans les démences de l'âge avancé [Wayfinding in dementia of old age]. *Médecine et Hygiène*, *37*, 3839-3842.

Rovine, M., & Weisman, G. D. (1989). Sketch-map variables as predictors of wayfinding performance. *Journal of Environmental Psychology*, *9*, 217-232.

Thomas, D. (1995). Wandering: A proposed definition. *Journal of Gerontological Nursing*, *21*, 35-41.

Verbrugge, L. M., & Jette, A. M. (1994). The disablement process. *Social Science and Medicine*, *38*, 1-14.

Weisman, G. D., Cohen, U., Ray, K., & Day, K. (1991). Architectural planning and design for dementia care units. In D. H. Coons (Ed.), *Specialized dementia care units: The Johns Hopkins series in contemporary medicine and public health* (pp. 83-106). Baltimore: Johns Hopkins University Press.

Zgola, J. M. (1987). *Doing things: A guide to programming activities for persons with Alzheimer's disease and related disorders*. Baltimore: Johns Hopkins University Press.