Diagnosis and Treatment of Environmental Wayfinding Difficulties
Case Study of a Student Health Center

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Abstract: Clinical visits require movement through complex, unfamiliar spaces during times of uncertainty and anxiety. This poses special challenges for designers. This paper addresses two conflicts of special significance to wayfinding in healthcare spaces. The first is how to direct visitors quickly and efficiently to their desired destinations, at times when perceptual resources may be devoted almost exclusively to pressing health issues. Given the unique confidentiality and privacy requirements of medical settings, a second, related issue is how to streamline and expedite pedestrian movement to clinical destinations, while clearly encouraging restrained, appropriate behavior once they arrive to protect privacy. Using live observation and survey methods this research investigates cueing and wayfinding behaviors among patients at a student health clinic and explores design means by which: a) directional information can be transmitted to inattentive pedestrians and b) activity can be alternately accelerated and decelerated as appropriate.

Key words: wayfinding, environmental design, privacy, healthcare, human behavior

1. Introduction

This research reports on wayfinding and cueing behaviors among student patients at a university health clinic. It was undertaken in an effort to understand and remedy problems faced by users of the clinic and staff related to identifying, reaching and appropriately cueing at the facility’s reception desk, its main arrival and information center, and pharmacy desk. Using live observation and instrumented documentation researchers assessed the impact of several environmental information components on the clarity and control of destinations and routes.

2. Conceptions of “Wayfinding”

2.1 Wayfinding Process

Without question, civilizations have exhibited a long-standing tolerance for—even a fascination with—being disoriented [1,2]. However, with certain recreational and ceremonial exceptions, individuals expect the time spent walking to be efficient for reaching intended destinations. It would be nice to think that humans are, when absolutely necessary, able to fall back on an internal sense of polar-orientation or geographically-based system of alignment with the world to help facilitate movement. However, scientific investigation has found that such evidence of extraordinary wayfinding is easily explained as keen attention to paths and landmarks and easily disproven as a heightened sense of geographical orientation [3,4]. Consequently, in the absence of an innate orientation system, pedestrians not only expect buildings to provide direct, efficient routes between spaces, they also expect to be provided with the information necessary to use these routes efficiently; they assume that buildings will provide a variety of reliable directional aids or “cues” [5]. This navigation of space based on
various environmental cues is generally called “wayfinding,” defined as “the purposeful, directed, and motivated movement from an origin to a specific distant destination that cannot be directly perceived by the traveler [6].”

For the most part, wayfinding involves an interaction among: a) pedestrian user(s) of space seeking specific destinations, b) the designers of spaces who have sought to anticipate and facilitate user aims via the appropriate introduction of directional cues and c) fixed and variable aspects of the building context itself [7,8]. Authors differ in terms of the specific steps they ascribe to the wayfinding process. However, in unfamiliar settings they all describe a process whereby pedestrians search for relevant directional cues and infer composite meaning from them before using their conclusions to actually seek their goal(s). Raubal [9] describes this as a “Sense-Plan-Act” framework (see Golledge [8] and Passini [5] for more detailed views of the wayfinding process).

2.2 Exterior Wayfinding Cues
The kinds of cues from which building users might deduce useful directional information are widely varied. One geographical language frequently cited in reference to pedestrian movement is found in Kevin Lynch’s classic work based on outdoor settings [10]. He maintains that users of urban outdoor spaces form mental “maps” of their pedestrian experiences, images structured and expressed in terms of: a) paths, b) nodes, c) landmarks, d) edges and e) districts. Of these dimensions, urban wayfinding theorists have historically tended to emphasize the importance of landmarks [11,12] and paths [10,13,14] as dominant directional cues in the outdoor setting.

2.3 Interior Wayfinding Cues
Landmarks have been found to be among the most potentially valuable of directional cues [15,16]. However, their day-to-day utility is normally severely limited by the closed vistas that make them difficult to spot inside buildings. Given this limitation, signs and maps have been hailed as the primary means of directional facilitation [17] and interior cues have historically enjoyed more frequent emphasis.

Through determination of user patterns or destination, researchers can understand how a facility operates and can reinforce those destinations [17]. Wayfinding can be incorporated into design by visual access through clear lines of sight, architectural delineation by separation, signage, and building layout by spatial progression [18]. Signage used must communicate the information to the viewer very quickly, clearly, and memorably to facilitate correct paths and movement. Size and location must also be taken into consideration; too small and a sign is lost, but too large and it recedes into the background. Eye level works for positioning signs that users must be able to read; but above is better than below eye level, as taller objects or persons will block low signs [19].

Within all of wayfinding, articulation through contrast allows focus on directional cues. Possession of space, clearly defining the beginning and end, can be done through contrast as well; particular attention must be made to location. To establish a focal point, the hierarchy of signage through size, color and position are important, but the additional feature of narrowing naturally leads the eye to the desired location. Narrows also create a sense of constriction and encourage the pedestrian to stop. To create narrows, solid objects such as walls are effective, but more temporary or movable options exist; railings can create a physical barrier and are sufficient means to halt movement [20]. Objects such as tables, retractable barrier rope and posts, and partitions have the same effect.
Objects of different substances, surfaces, and textures allow persons to organize environments by articulated patterns through cognitive affordances [18]. The surface materials used, with regard to color, pattern and material can contrast with other elements. Consideration must be given to lighting, as the relationship between lighting and surface materials changes with time of day and seasonally. Sunlight is brightest from south and most intense from the west; if materials are too glossy, the glare can disturb perception of environmental factors.

2.4 Healthcare Setting

Every day within hospitals and clinics, people are expected to make decisions about how to navigate complicated interior spaces to locate their destinations. Successful spatial navigation is an important part of a building’s function. It tends to be complicated under the best of circumstances. However, in the often unfamiliar, inherently complex and stressful realm of healthcare environments, wayfinding becomes both more critical and complicated [21]. The facilitation of efficient directional movement is always challenging, in part because human movement through space is incidental to almost every aspect of building functioning. So, motivation, destination, time constraints and virtually all other personal influences on movement vary widely; not only between individuals but for each individual, from time to time. Contextual influences such as pedestrian density, light quality, flooring materials, interior design and signage can have a direct effect on emotional and physical reactions to space. This case study attempts to employ a coherent, multi-layered design strategy, to create an experience that envelops the visitor in meaning and promotes deeper understanding of privacy [17].

Many clinics and hospitals face problems in directing users from point-to-point within their facilities and maintaining patient privacy. Initial wayfinding experiences have marked impact on overall institutional efficiency and subsequent patient perceptions of quality. While a good deal of attention has been devoted to wayfinding in a wide variety of interior and exterior settings, one unique and critical aspect this research hopes to address is how to best facilitate wayfinding to regulate pedestrian movement to protect patient privacy. The design of the space within the health center can serve many uses: it can move people through space, identify objects and places, provide welcome or warning, explain, and protect privacy [17].

2.5 Privacy Laws

Due to the communicative nature of healthcare, there exits the potential for individual healthcare information to be disclosed accidentally. For example, another patient could overhear conversations or view sign-in sheets that contain patients’ names. The United States government, with the enactment of the Health Insurance Portability and Accountability Act of 1996 (HIPAA), Public Law 104-191, standardized the exchange, privacy and security of health information [22]. The Privacy Rule protects all individually identifiable health information held or transmitted by an entity or its business associates, in any form, whether electronic, paper, or oral. The protected information includes demographic data of an individual’s past, present or future physical or mental health conditions and includes common identifiers such as name, address, birth date, and identification numbers. In an attempt to control the release of information, administrative, physical, technical, organizational and procedural safeguards must be enacted by all locations involved with the use of healthcare data. Physical safeguards and their alteration to wayfinding behavior within a healthcare location are the stimulus of this research.
The section of the law (164.310(b)) regarding physical safeguards of workstation use requires a facility to “implement policies and procedures that specify the proper functions to be performed, the manner in which those functions are to be performed, and the physical attributes of the surroundings of a specific workstation or class of workstation that can access electronic protected health information [22].” The process of analysis of privacy is threefold: a) identify all methods of physical access to workstations, b) analyze the risk associated with each type of access, and c) identify and implement physical safeguards for workstations. In order for the law to be effective in its execution, healthcare facilities needs to have a working system of maintaining physical boundaries through wayfinding. Regardless of whether a country has privacy laws, globally privacy should be protected.

3. Methodology

3.1 Identification of Site Problems

This research investigates cueing and wayfinding behaviors among patients at a student health clinic. Using live observation, researchers assessed the impact of several environmental components on the clarity of destination and effectiveness of privacy measures. The wayfinding process includes various aspects that pedestrians face while in transit: user awareness, knowledge of required destination, prior familiarity, directional cues, legibility, and memorability. Multiple cues include human sources, descriptive sources, sensory sources, and pathways. The researchers assessed the inclusion of these within the lobby of the Thelen Student Health Center at Iowa State University [Figure 1]. The lobby contained two benches for waiting, near the pharmacy entrance; the benches logically followed the architectural columns and contributed to the ideation of deceleration of movement towards the pharmacy desk. Two circular tables in the line of sight upon entering encouraged the users to turn towards the check-in desk, as the tables do not act as significant landmarks. The benches and table would remain in this position for later observations. A table, covered in promotional materials, and a sign acted as the HIPAA barrier to prevent pedestrians from immediately approaching the front desk. These were not aligned with the natural line of the columns, nor oriented to reflect the check-in desk. The clutter on the table distracted from the HIPAA privacy barrier sign, which was an actual printed STOP sign. Additionally, a chair placed behind the table sent mixed signals as to which desk was the actual check-in. While the inclusion of plants as a natural element is healing, they were not utilized to contribute to directional cueing and were cluttered at the end of the check-in desk. Permanent wayfinding signage included painted signs on the wall, above the waiting room, patient check-in, and pharmacy.

Figure 1. Student Health Center Original Elements
A discussion with the staff was conducted to determine problems observed on a daily basis and the common paths visitors took. The staff’s observations reported that 90 to 95% of persons who use health services during a semester go to the check-in desk and a fundamental problem existed in getting them to stop behind the HIPAA signs, rather than directly approaching the desk. By establishing distance between the check-in desk and the waiting line for the other patients, healthcare facilities reduce the risk of both visual and auditory sharing of information, as staff could be directly communicating with a patient, on the phone, or handling paperwork. The patients of the health center have multiple and varied needs and after check-in, proceed back to the waiting room, lab, or upstairs. A small percentage go directly to the pharmacy, with no need to check-in, but they also need to stop at a HIPAA signs to maintain patient privacy.

3.2 Changes Made to Site
Elements that remained, from the original design, were two benches for waiting near the pharmacy entrance; the benches followed the architectural columns and contributed to the ideation of deceleration of movement. The circular tables in the line of sight upon entering encouraged persons to turn towards the check-in desk, as the tables do not act as a significant landmark. Additionally, the permanent signage painted on the wall, above the waiting room, patient check-in, and pharmacy, was done appropriately above eye level so that elements of other persons would not block the view [Figure 2].

![Figure 2. Student Health Center Design Elements](image)

The table from the original configuration was cleared off of all promotional materials; it and two additional tables were aligned following the natural architectural line of the columns. Two tables were placed together, with a space between the third, located directly in front of the check in desk. The plants, previously cluttering the end of the desk, were relocated to the end of the line of tables, creating a narrower path between the tables and the benches, in hope to designate the second opening as the queue for the pharmacy [Figure 2]. Regulation of walkways has the capability to protect privacy; just as landscape artists use hedge lines to make yards private, the use of tables to stop flow of traffic from moving forward can protect information at check-in desks [18].

The HIPAA barrier sign, originally a STOP sign, was redesigned. Typographically, signs are easier to read in normal orthography of upper and lower case letters, as ascenders and descenders make letters look different; however signs such as STOP in all capitals are used to command an air of authority [19]. To retain authority, the signs were designed using a combination of traditional orthography and all capitals: Please WAIT HERE for the
next available representative [Figure 3]. By adding justification of why persons need to stop, meaning was added to the cue. The font was increased in size to have more visual presence as well. Hierarchy within the signage was maintained: the large signs posted on the walls above the stations read Waiting Room, Patient Check-In, and Pharmacy and once the visitor has identified their destination, both the pharmacy and the check-in desk contain the smaller HIPAA signs. The color red, from a traditional stop sign, was retained for visual punctuation.

Mollerup [19], among others, has made a strong argument for learning how the many naturally occurring elements of the built environment can overtly and covertly influence direction decision-making. In this case, subliminal cues of direction were articulated through contrast by introduction of a high contrast stripe; dark floor runners were added over the light floors to direct individuals from the door to between the tables. An intentional break was made between the runner leading to the check-in desk and the runner along the desk that leads to the waiting room [Figure 3]. The intention was that the line of tables, combined with the HIPAA signs and the break in the runners would visual and subliminally lead persons to the desk, while facilitating deceleration of approach.

Wayfinding must allow the user to translate two-dimensional signs into the three-dimensional space, which is best achieved by emulating the preexisting three-dimensional context. Within the student health center the HIPAA signs could have posted in various locations and positions. However, having them near eye level catches attention, while including them within the plane of the tables establishes a relationship of a barrier. The tables, runners, and plants form a reciprocal relationship with the signage to decelerate movement.

3.3 Observational Process

Following analysis of the space and changes to the interior layout and signage, observations were made of the visitors. Observations were made nine times, three times each from 7:30 a.m. to 8:40 a.m., 11:10 a.m. to 12:00 noon, and 2:15 p.m. to 3:05 p.m., accumulating 49, 54, and 68 subjects respectively. Researchers noted group size, gender, and approximate age, as well as the path taken, hesitation upon entry, and stoppage at the posted signs. As this was an intervention approach to solving a problem for privacy legality within one week, researchers only observed the collected information and did not interact with subjects to learn actual age or whether they had previous experience with the space.
Additionally, a floor plan of the lobby was drawn up, detailing the interior layout and locations of signage utilized within the lobby [Figure 2]. During each observational time frame, the paths of the subjects were drawn on the map to note commonalities and discrepancies of paths taken and establish patterns in behavior. The relationship of paths could be compared to the time of day of the observation for potential light interaction.

### 3.4 Data Analysis

In all, 171 subjects were observed; of these, 92 (54%) were female and 79 (46%) were male, ranging in age from 20 to 70 years, with the mean age of 26 years, representational of the general student population of the university, which is 44% female and 56% male with a mean age of 23 years [23]. The small increase in average age should consider the fact that the subjects included university faculty and staff, whose ages are not available for inclusion within the university averages. The majority of the subjects (128 subjects: 75%) came in individually, while the remainder arrived in groups of two or three. Observations confirmed the staff’s statements of the most common paths taken by subjects were to check-in (62% observed), pharmacy (19% observed), and upstairs to the wellness center (5% observed). Individuals who went to the check-in desk continued to the waiting room, lab, wellness center, and appointment desk.

Findings revealed 43 (25%) subjects were called to a desk by a staff member immediately upon arrival and therefore had no need to determine their path or utilize posted signs; they were excluded from further analysis. The other 129 individuals, those not immediately called to the desk, needed to analyze the space to locate their destination and route. Of these, 74 (57%) were female and 55 (43%) were male. Subjects ranged in age from 20 to 70 years, with the mean age of 27 years, varying only slightly from the demographical makeup of the entire subject population.

These subjects were broken down further into: a) those who stopped at the check-in or pharmacy HIPAA sign, b) those who did not stop at either and c) those for whom the sign was not applicable, that is, individuals who used paths such as to the stairs, lab, or restroom, showing familiarity with the site and desired destination [Table 1].

<table>
<thead>
<tr>
<th>Use of HIPAA Sign</th>
<th># of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stopped at Check-In Sign</td>
<td>52</td>
</tr>
<tr>
<td>Stopped at Pharmacy sign</td>
<td>12</td>
</tr>
<tr>
<td>Did Not Stop at Sign</td>
<td>19</td>
</tr>
<tr>
<td>Sign Not Applicable</td>
<td>46</td>
</tr>
</tbody>
</table>

Comparisons can be made between the demographics, observations, and paths of the 19 subjects who did not stop at the stop sign and the 64 subjects who stopped at a HIPAA sign. The subjects who stopped at the HIPAA sign were 50% male and 50% female. The mean age was 24 years, ranging from 20 to 45 years. The subjects did not only come to the health center individually; while 83% came alone, 12% came with another individual and 5% came with two other individuals. This is in contrast to those who did not stop, as the data will reveal all of those subjects came alone. The subjects went to the check-in at a rate of 80% and the pharmacy at a rate of 20%.  

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Of subjects who did not stop, 11 (58%) were male and 7 (42%) were female, an increase of males in comparison to the entire subject population. The mean age was 24 years, with a range from 20 to 40 years. These numbers are equally distributed between time of day, with 6 subjects each in the a.m. and at noon and 7 subjects in the p.m., leading to the belief that sunlight and glare do not have a direct effect on the wayfinding at this location. All the subjects came to the health center individually and they went to the check-in desk (63%), and the pharmacy (21%) at the same rates as the entire subject population. The paths taken by the individuals reveals that they either used the correct path following the runners between the table to check-in but did not stop at the posted HIPAA signs or went through the space between the table and column, intended to lead to the pharmacy, and by doing so, circulated in a manner that bypassed a HIPAA sign for the check-in desk [Figure 4].

![Figure 4. Paths Taken](image)

4. Conclusions

4.1 Emergence of “Way-Stopping”

While designers have long rallied their study of directional facilitation around the label of “wayfinding,” more recently we have come to appreciate the important distinctions between what pedestrians experience as wayfinding and designers seek to practice as way-showing [20]. One very interesting and important revelation that came out of this study is that directional facilitation is not always about pedestrian movement. It is sometimes just as important to successfully stop or reverse forward progress, in what might be considered way-regulation. Certainly, concerns for privacy and confidentiality are practical concerns, as clearly evidenced by the requirements of the HIPAA standards. The spatio-graphic configurations used in this field application were not wholly successful in stopping subjects where intended. However, they did prevent 77% of individuals for whom the measures were intended from approaching the desks without stopping. This concept of way-regulation or stopping represents a promising, potentially valuable new contribution to the field.

4.2 Significance of Group Versus Individual Movement

A significant finding was the importance of action in a group as a factor in wayfinding. For subjects observed in this study, group performance differed markedly from individual actions in terms of responding to cueing information. There was a difference between those who stopped regularly at stop cues and those that did not; all the subjects who did not stop were functioning as individuals. While the notion that groups perform more appropriately than individuals might, at first, appear counterintuitive, there are several studies that provide plausible explanations. First, in their discussion of “agent-based” pedestrian modeling, Willis [24] observed that
at least two spatial factors influence pedestrian movement: a) “preferred gap size,” the smallest space into which a person is willing to move, and b) “personal space preference,” the amount of space a person wishes to have around him/herself. The tendency for groups to respect stop cues could potentially have occurred due to the narrowing of the space by tables through which they had to pass in order to reach the check-in desk.

Another explanation is offered by Laughlin [26] who noted that one of the advantages of many group processes is that there are more people attending to the group goal which gives them the performance advantage of being able to act based on the fastest person to detect relevant information. As applied to wayfinding, a group is able to use multiple persons for sensory input. One final explanation comes from a study of pedestrian movement on stairs, which found that groups actually performed more safely and efficiently on stairs, making fewer stumbles, perhaps because they are paying less attention [27]. The natural conversation among group members allowed them to function less self-consciously and fall back on more efficient, internalized methods of performing.

In any event, for persons to successfully navigate an environment, they must continually assess and respond to different stimuli and persons who occupy healthcare facilities are often “cognitively compromised by injury, degenerative disease, or elevated levels of stress; their walking and wayfinding abilities may be impaired [18].” Therefore, it is essential that the wayfinding and design of the space be as straightforward as possible.

4.3 Future Directions

Suggestions for additional improvement of the space include raising the level of HIPAA signs, based upon the knowledge that a larger percentage of those who did not stop were male, the assumption it that males are taller in stature and would benefit from a higher eye level position. Trials of various graphic components within the HIPAA barrier sign, including colored background with white text or traditional orthography use could additionally improve visual presence. Also, the addition of floor length banners added to the front of the tables could help create a stronger barrier.

Areas for future research include a continued look into wayfinding as a method to protect privacy, rather than to progress motion. Testing various configurations of interior elements and alternative signage through continued observation of the university health center could help to determine additional effective elements in directing pedestrians and protecting patient privacy through the acceleration and deceleration of movement.

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5. Citations