HOSPITAL DESIGN AND WAYFINDING
A Video Simulation Study

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ABSTRACT: A videotape simulation of the entrance drive to the new University of Michigan Hospital was used to test the effect on turning behavior of constructing a parking deck entrance directly off the hospital's drop-off circle. One hundred randomly sampled visitors were shown this videotape and asked where they would turn, if they were coming alone to visit a patient and needed to park their car. There were several turn-off areas along the entrance drive before the parking deck turn-off. Each turn-off had a sign listing its respective functions and directed drivers to continue straight ahead for parking. Half the visitors saw a videotape in which there was an entrance to the deck from the drop-off circle, and half saw a tape in which the entrance from the drop-off circle was absent. Each visitor saw two scenarios, one having the drop-off circle crowded with cars, and one uncrowded. The results of the study showed that the presence of the entrance to the deck from the drop-off circle did make a significant difference in reported

AUTHORS' NOTE: *This study appears in Carpman, Grant, and Simmons (1984).*

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turning behavior. The results of this study had a direct impact on the subsequent design decision. In addition, the results of this study are meaningful beyond the data themselves. The study used an inexpensive, simple, and highly imageable research technique, yet one rarely used in environment-behavior research. It was a "quick turn-around" research effort that resolved a specific design dilemma. The study also demonstrates that signs alone are not sufficient to guide wayfinding behavior in large complex environments like hospitals.

At the present time, the University of Michigan is in the process of constructing a new adult general hospital and an ambulatory care facility as part of its Replacement Hospital Program. The new hospital will contain 232 semiprivate beds (116 rooms), 232 private beds, 52 adult psychiatric beds, and 70 adult intensive care beds, for a total of 586. By 1990, the total University of Michigan Hospitals' complex is expected to care for 28,000 inpatients annually and to provide 400,000 visits through its ambulatory care clinics. As part of the hospital design process, the Patient and Visitor Participation (PVP) Project was initiated. The purpose of the Patient and Visitor Participation Project is to combine empirical research and advocacy in order to influence the design and policymaking processes in such a way that the needs of patients and visitors are accommodated. As such, the PVP Project has been involved, on an ongoing basis, in systematic research and advocacy on various design-related issues (Reizenstein and Grant, 1982).

PARTICIPATION IN DESIGN

It is well-established that hospital patients and visitors are vulnerable user groups for whom the physical environment can be a source of stress. This stress can unnecessarily impede patients' abilities to recover from their illnesses. It can also increase hospital costs and

decrease the quality of life for both patients and visitors (Shumaker and Reizenstein, 1982). Despite the impact of hospital design and management on patients and visitors, few relevant studies have attempted to involve these groups in the design process (Reizenstein, 1982). However, behavioral research that focuses on the needs of hospital patients and visitors can be an integral part of a hospital's design process. The study reported here documents the use of behavioral research to help solve a real design problem.

THE PROBLEM

A frequent complaint of first-time visitors to a large, complex building like a hospital is that signs do not lead them where they need to go. These visitors say that either there are too few signs, signs are in the wrong places, or that their destinations do not appear on the signs. But how important a role do signs really play in helping people find their way? Do most people follow signs or are they also scanning the environment to pick up other wayfinding cues?

This question was examined by the PVP Project, in conjunction with a concern raised about potential traffic congestion at the main entrance to the new Medical Center: specifically, the relationship of the proposed drop-off circular drive at the hospital's main entrance to the visitor's parking structure. Figure 1 shows that the parking structure will stand in close proximity to the circular drive. The placement of entrances to the parking structure was thought to affect traffic flow and ultimately traffic congestion at the hospital entrance. As planners estimated that more than 700,000 cars will use the structure each year (over 2,000 cars each day), choosing a design that limited congestion and confusion was important.

One proposal was to construct a north entrance to the parking deck directly off the drop-off circular drive (see

Figure 3). There would be an additional entrance on the east side of the deck (off the main road). Proponents of this scheme believed that this design would give drivers the option of entering the parking deck after dropping someone off in front of the main entrance. Another proposal was to have both entrances to the parking deck on the east side (see Figure 2). Advocates of this scheme felt that having an entrance directly off of the drop-off circle would lure drivers into the drop-off circle, causing traffic congestion.

Environment-Behavior research was seen as a way in which these two differing views could be resolved. Rather than asking prospective drivers—in this case, visitors to the hospital—which scenario they would prefer (possibly resulting in the same division as described above), the decision was made to ask them what they would actually do given a certain situation. Because the behaviors of drivers was what was being argued, this seemed to be a useful approach.

STUDY METHODS

In order to obtain a realistic image of what the entry drive and drop-off circle might look like, the research needed to simulate an environment not yet built in such a way that it was both highly imageable and understandable. That is, a research method was sought that would involve the participants and use their capacity to put themselves into an environment, to react "as if" the simulated environment was real (Kaplan and Kaplan, 1982). Building on work done previously with environmental simulation (Appleyard, 1977, Appleyard and Craik, 1974; Craik, 1975; McKechnie, 1977) a videotape simulation technique was chosen.[1]

Videotape simulation involves using a specially adapted video camera that can move through and around a small architectural model. When this image is projected on a television monitor (see Figure 4), it looks very much like one is moving through the actual space, thus reducing the

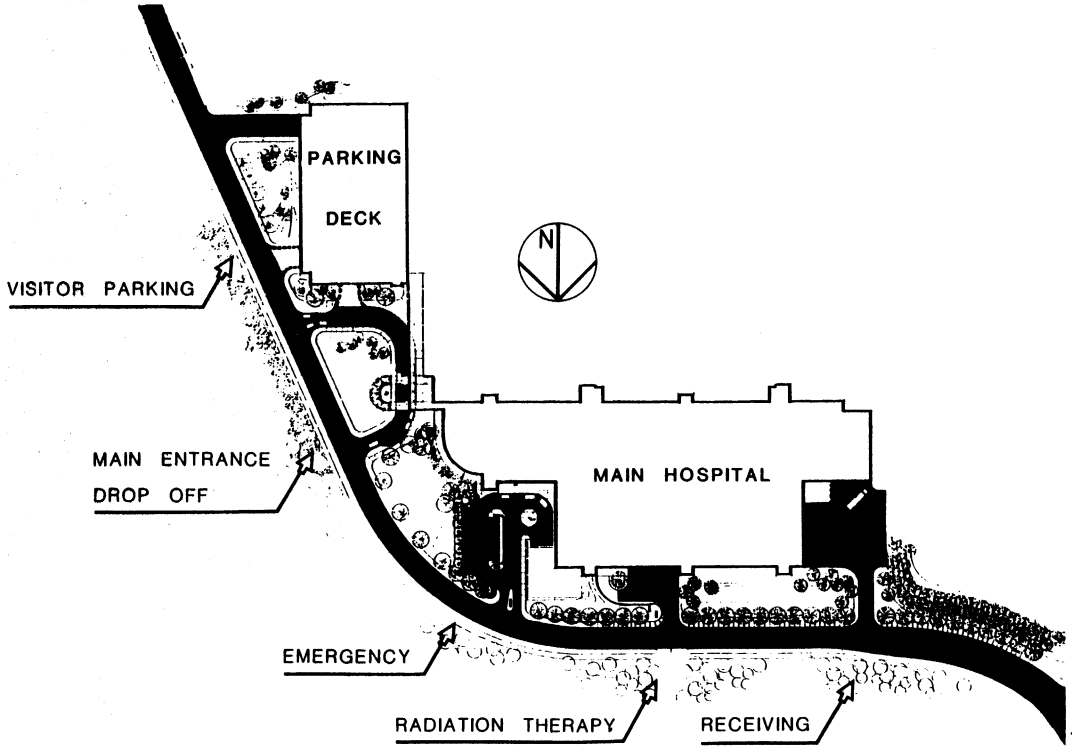


Figure 1: A Schematic Diagram of the Hospital Entrance Drive

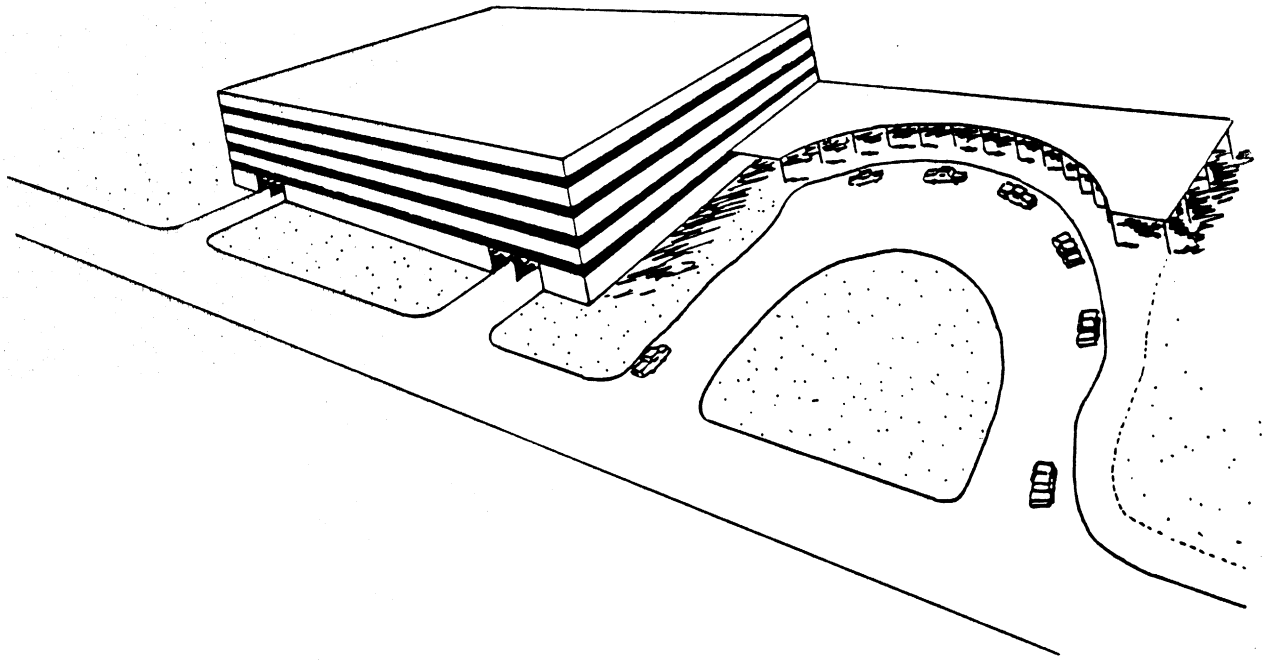
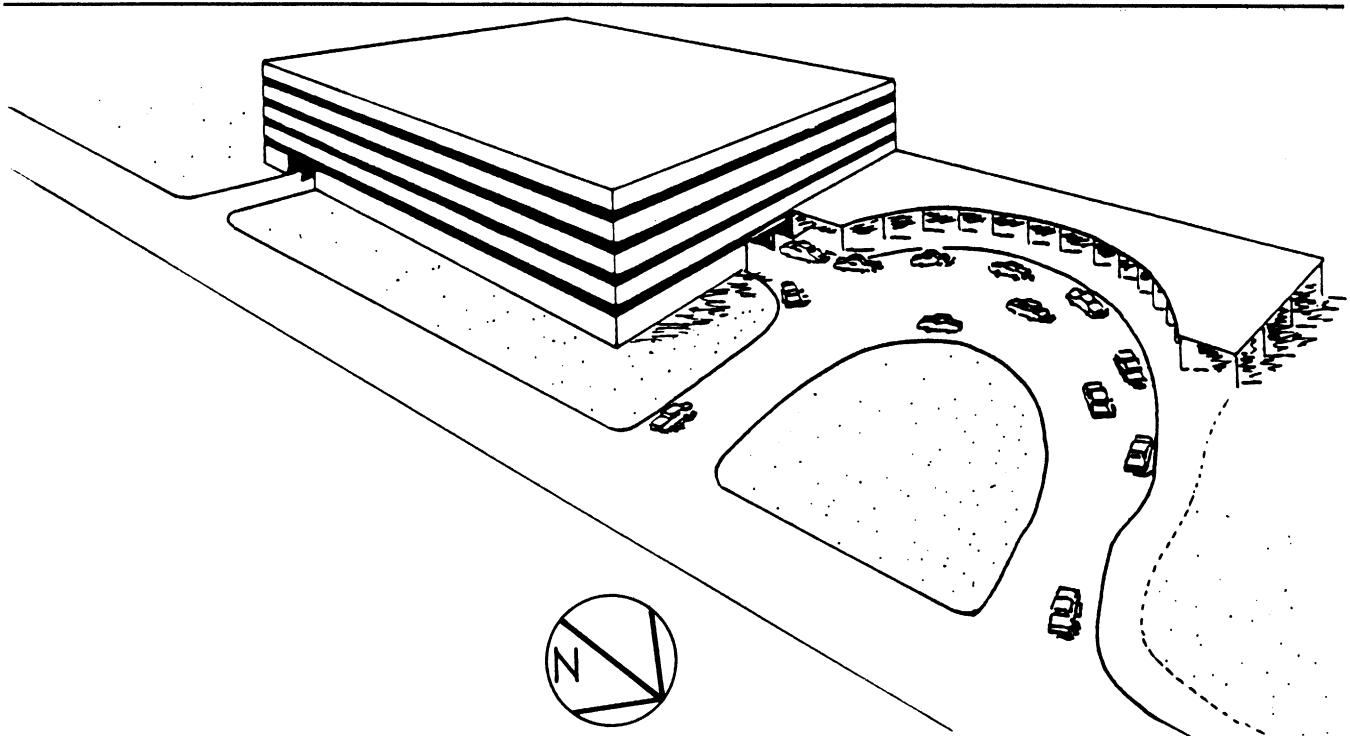
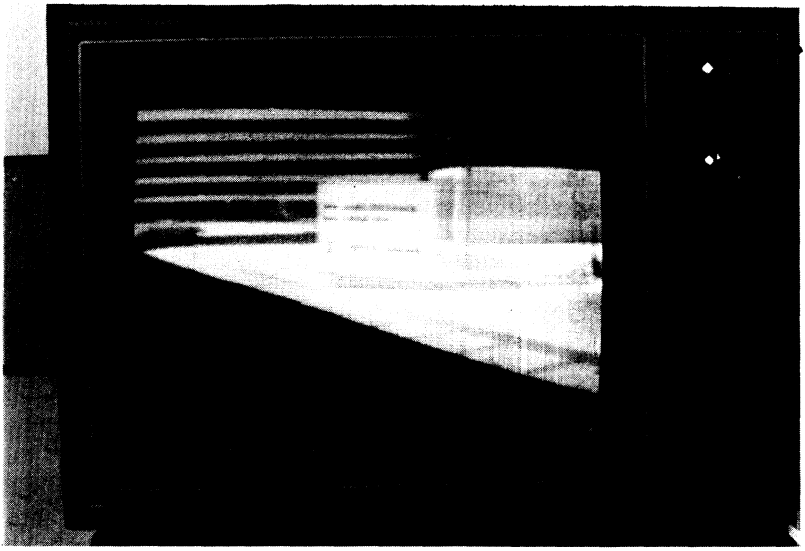


Figure 2: Parking Deck Without North Entrance in the Uncrowded Condition



NOTE: Other scenarios were North Entrance Absent, Crowded; North Entrace Present, Uncrowded.

Figure 3: Parking Deck with North Entrance in the Crowded Condition



NOTE: Due to photographic and printing processes, this image looks much less clear here than it did on the monitor.

Figure 4: Model as It Appears Through TV Monitor

problem of scale differences that often get in the way when people look at small models (Seaton and Collins, 1972).[2]

The research team decided that they would simulate the automobile ride from the entrance of the medical campus, along the north face of the hospital, to the drop-off circle and parking deck (see Figure 5). A model was built of this entry drive at a scale of ⅛ inch = 1 foot. Foam core board was used for the building facades and steel wool for trees. Small signs were made directing visitors to various turn-off areas: Receiving, Radiation Therapy, Emergency, Main Entrance/ Drop-Off, and Visitor Parking.

With various scenarios simulated on videotape, hospital visitors could watch a television monitor and then tell the researcher what their turning behavior would be. In this case, turning behavior was thought to be a function of several variables. The first was presence or absence of the north entrance to the parking deck (directly off the drop-off

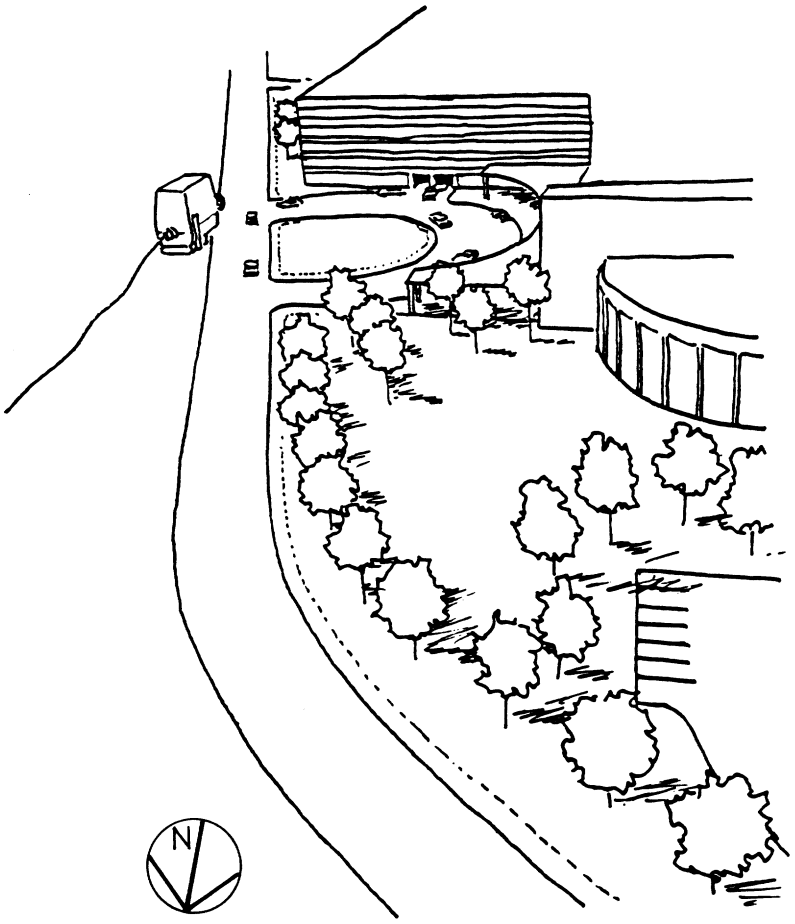


Figure 5: Video Camera Aimed Toward the Parking Structure

circle; see Figures 2 and 3). Half the sample saw a videotape that contained the north entrance and half saw a tape that contained no north entrance.

The question about relative importance of signs when compared to other wayfinding cues in the environment was central to this research approach. The key signs were the ones that directed people to the Main Entrance/Drop-off and the two directing people to Visitor Parking.

The scenario with the north entrance visible had a visual cue and a sign cue. Upon arriving at the drop-off turnoff, drivers could see the entrance into the parking deck from the drop-off circle. They could also see a sign that directed them to continue straight ahead to find parking. The visual cue and the sign cue contradicted each other. In order to choose to enter the parking deck through the traffic circle, visitors had to feel that the visual cue outweighed the verbal cue of the sign. By the same logic, those who did not say they would enter the parking deck through the traffic circle relied more on the verbal sign cue than on the visual cue of seeing the entrance itself.

The research team thought that another important variable might be the crowdedness of the drop-off circle (number of cars). Respondents were shown two scenarios, one with a crowded drop-off circle and one with an uncrowded circle. Finally, age, sex, and education were hypothesized as having an influence on response. Taking into consideration each of these variables, four different scenarios were provided, and respondents were randomly assigned to one of the four:

(1) north entrance present, crowded situation first
(2) north entrance present, uncrowded situation first
(3) north entrance absent, crowded situation first
(4) north entrance absent, uncrowded situation first

One hundred hospital visitors were randomly sampled in different public spaces (lobbies and waiting areas) throughout the hospital. After agreeing to participate in the study, they were given the following instructions:

> I'd like you to imagine that you are driving along this road, you are alone and you are coming to visit someone in the hospital. I'd like you to tell me where you would turn in off of the entry drive to park your car. Now there's no right or wrong answer; this isn't a test. We just want to know what you would do. I'd like you to point to the TV screen and tell me where you would turn, the instant you decide to turn.

The videotape was then run and the respondent pointed to the place where he or she would turn. The researcher recorded the turning point. The respondent's sex, age, and education were also recorded. Interviews averaged 10 minutes in length. Many of the participants commented that they enjoyed the task and were pleased to be consulted.

RESULTS

PRESENCE OR ABSENCE OF NORTH ENTRANCE

As can be seen in Table 1, more visitors said they would turn in the parking deck (75.5%) where the sign read "Visitor Parking" than said they would turn into the drop-off circle (24.5%) where the sign read "Main Entrance/Drop-Off." However, the presence of the north entrance to the parking deck (the one located off of the drop-off circle) did affect reported turning behavior. Table 1 shows that significantly more people said they would turn into the drop-off circle drive when there was a north entrance to the parking deck than when there was no north entrance. It is important to note that these people said they would turn into the drop-off circle even though the sign instructed them to keep going. For these people the visual cue of the entrance seemed to override the verbal cue of the sign.

The effect of the entrance on choice remained strong when controlling for crowdedness (see Tables 2 and 3). When the north entrance was present, virtually the same number of people reported turning into the drop-off circle during the crowded and uncrowded conditions (37.7% and 35.8%, respectively).

CROWDEDNESS OF THE DROP-OFF CIRCLE

Controlling for the presence or absence of the north entrance and the number of cars present in the drop-off

TABLE 1
Turning Choice Location by Presence of North Entrance to Parking Deck

		Presence of North Entrance		
		Yes	No	TOTAL
Turning Choice	Drop-Off Circle	39 36.8%	10 10.6%	49 24.5%
	Parking Deck	67 63.2%	84 89.4%	151 75.5%
	TOTAL	106	94	N=200

NOTES: Chi-Square = 18.423 (DF = 1); $p < .0001$; Goodman-Kruskal's Tau = .0921.

TABLE 2
Turning Choice by Presence of North Entrance to Parking Deck, Controlling for Crowdedness

UNCROWDED CONDITION

		Presence of North Entrance		
		Yes	No	TOTAL
Turning Choice	Drop-Off Circle	19 35.8%	3 6.4%	22 22.0%
	Parking Deck	34 64.2%	44 93.6%	78 78.0%
	TOTAL	53	47	N=100

NOTES: Chi-Square = 12.604 (DF = 1); $p < .0004$; Goodman-Kruskal's Tau = .1260.

circle did not appear to affect the reported turning behavior of visitors. As shown in Table 4, 22.0% of the respondents said they would turn into the drop-off circle in the uncrowded condition, whereas 27.0% said they would turn into the drop-off circle in the crowded condition. This does not represent a significant difference in reported behavior.

TABLE 3
Turning Choice by Presence of North Entrance to Parking Deck, Controlling for Crowdedness

CROWDED CONDITION

		Presence of North Entrance		
		Yes	No	TOTAL
Turning Choice	Drop-Off Circle	20 37.7%	7 14.9%	27 27.0%
	Parking Deck	33 62.3%	40 85.1%	73 73.0%
	TOTAL	53	47	N=100

NOTES: Chi-Square = 6.5942 (DF = 1); $p < .0102$; Goodman-Kruskal's Tau = .0659.

TABLE 4
Turning Choice by Scenario

		Scenario		
		Uncrowded	Crowded	TOTAL
Turning Choice	Drop-Off Circle	22 22.0%	27 27.0%	49 24.5%
	Parking Deck	78 78.0%	73 73.0%	151 75.5%
	TOTAL	100	100	N=200

NOTES: Chi-Square = .67577 (DF = 1); $p < .4110$; Goodman-Kruskal's Tau = .0034.

As might be expected, order of presentation, whether the crowded scenario or the uncrowded scenario was presented first, did not affect the reported turning behavior of visitors. Table 5 shows that whereas 21.3% of the respondents said they would turn into the drop-off circle

TABLE 5
Turning Choice Scenarios

		Order of Scenarios		
		Uncrowded First	Crowded First	TOTAL
Turning Choice	Drop-Off Circle	20 21.3%	29 27.4%	49 24.5%
	Parking Deck	74 78.7%	77 72.6%	151 75.5%
	TOTAL	94	106	N=200

NOTES: Chi-Square = .99625 (DF = 1); $p < .3182$; Goodman-Kruskal's Tau = .005.

TABLE 6
Turning Choice by Education Level

		Education Level		
		No College	College	TOTAL
Turning Choice	Drop-Off Circle	32 30.8%	17 17.7%	49 24.5%
	Parking Deck	72 69.2%	79 82.3%	151 75.5%
	TOTAL	104	96	200

NOTES: Chi-Square = 4.6037 (DF = 1); $p < .0319$; Goodman-Kruskal's Tau = .0230.

when the uncrowded scenario was presented first, 27.4% said they would turn into the drop-off circle when the crowded scenario was presented first. Again, this does not represent a statistically significant difference.

BACKGROUND VARIABLES

Of the three background variables examined (age, sex, and education), only education was found to make a difference in turning behavior. Table 6 shows that nearly twice as many of those with no college education elected to turn into the drop-off circle than those with at least some college level training.

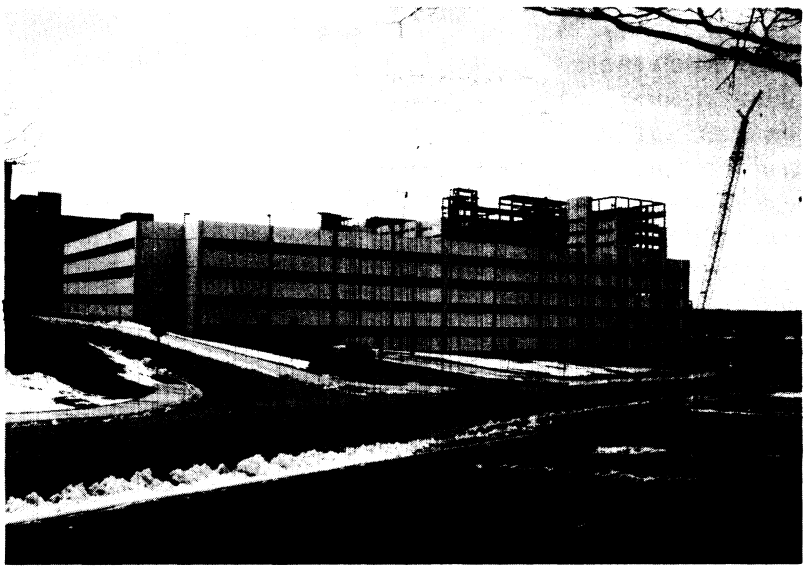
DISCUSSION AND CONCLUSIONS

Clearly, more research is needed to look at the roles of signs and visual cues. However, these results point out that, at least in this situation, visual environmental cues outweighed the verbal cues available on signs for a significant percentage of the sample. Specifically, having a north entrance from the drop-off circle to the parking deck led people who were not dropping anyone off to turn into the drop-off area in order to enter the parking deck. Being able to see this entrance seemed to draw people to use it, despite signs directing them elsewhere.

This finding held regardless of the number of cars in the circular drive, the order of crowded or uncrowded scenarios, and age or sex. The only background factor that made a difference was the respondent's education. Although a majority of respondents, both college and non-college educated, chose not to turn into the drop-off circle, educational level did affect turning behavior. People with less education were more likely to follow visual cues (presence of a north entrance) than those with a college education, who were more likely to follow signs.

In light of the findings of this study, the research team recommended that an entrance to the parking deck not be built off the drop-off circle. Regardless of signage, if this entrance was present, it would likely be used by people other than those dropping off passengers and thus would cause unwanted congestion.

The findings and recommendations of this study were presented at a special meeting of designers and planners



NOTES: This parking deck was built as recommended. There is no entrance from the drop-off circle. The new hospital, under construction, is in the background.

Figure 6: Parking Deck with Both Entrances from the Main Road

who were to make a decision about the location of the parking deck entrance. Although several hours had been set aside for discussion and debate, after this study was presented the decision was made quickly and unanimously not to build a north entrance.

However, the results of this study are exciting and meaningful beyond the data themselves. First, this study took advantage of an inexpensive, simple, and highly imageable research technique, yet one that is rarely used in Environment-Behavior research. Given the availability of a specially adapted videotape camera, videotape simulation is multiply advantageous. With a small cash outlay and basic model-building skills, researchers can bring potential environment users "inside" or "through" an environment that otherwise exists only on paper. This technique enables researchers to obtain reactions to the designed en-

vironment at a much smaller cost than would be involved in a full-scale mock-up (for example, see King et al., 1982) and with much more accuracy and reliability than is possible when asking people to form three-dimensional cognitive images from two-dimensional floor plans. The portability of a videotape monitor (TV screen) and recorder also make a videotape simulation viewable by large numbers of potential respondents.

Second, this project was a quick "turn-around" research effort (less than 14 days from identification of the problem to presentation of the results) that resolved a specific design dilemma quickly and clearly. As such, it showed that social research does not have to be dull, lengthy, or evasive (Reizenstein, 1975). As a side benefit, this study (one of the first of the Patient and Visitor Participation Project) helped to establish the research team's credibility and reputation for being able to respond to design-related questions quickly and usefully. This "research" technique of videotape simulation helped blur boundaries between researchers and designers (Zeisel, 1981) by showing designers and design decision makers a moving, visual, three-dimensional image of the drive to the new hospital; one they had not seen previously.

This study may also have implications for approaching the issue of wayfinding in other complex environments. Signs alone have often been relied upon to convey all information first-time users may need. This study demonstrates that signs alone are not enough. Instead, a series of compatible elements—what we are calling a wayfinding system—is necessary in order to effectively direct people through a complicated building or exterior area. Such a system may include the layout of the building, signs, sensory cues (including smells and noises), maps, verbal directions, landmarks, and others (Weisman, 1982). Design decision makers need to recognize the many elements that can comprise a wayfinding system and design the system so that these elements are mutually reinforcing.

NOTES

1. The equipment used in this study was developed by Professor Lester Fader of the University of Michigan School of Architecture. For further information, contact Fader Photoworks, 1402 Bardstown, Ann Arbor, Michigan 48105.

2. A black and white Sony surveillance videotape camera (AV1400) with an 8.5mm wide angle optic was used. The simulated rate of movement was 15mph. The camera operator moved the camera relatively smoothly in order to simulate a car's movement. The simulated eye level was approximately 12 feet above that of a typical driver. Simulated signs were readable by viewers of the videotape. The videotape ended after both entrances to the parking deck had been passed. The camera then proceeded along a "road" beyond the parking deck and faded out.

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