CHOOSING A PATH IN THE UNDERGROUND: VISUAL INFORMATION AND PREFERENCE

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Abstract

Visitors to shopping centres often make up their walking itineraries as they go along. At choice points, paths are selected according to the available information in the immediate surrounding area. In Underground systems, where it is difficult to convey layout of a whole area, visitors are especially reliant on such visual information. In this exploratory study, we investigate the relationship between path choices in a real Underground system and interpretations the visitors make of the path choices. In a first experiment with 6 Underground intersections, 32 participants were asked to select paths for exploration from 360° panoramic photographs and to respond a set of questions concerning the various choices. In a second experiment, 31 participants were asked to select paths from line drawings of the same corridor intersections. In both experiments, participants clearly expressed preferences for certain pathways over others. Preferred pathways were associated with the presence of people, the amount of shopping opportunity available and more path choices. Least preferred pathways were associated with changes in elevation, unclear circulation, apparent dead-ends and low visual stimulation.

Background

While visitors to shopping environments tend to have general plans for their visits, a specific itinerary is seldom planned (Bloch et al, 1991). Visitors often make decisions about paths to take and places to visit as they move about. A study on wayfinding conducted by Passini (1984) found that subjects were "engaged in an ongoing process of decision making as they encountered new information and recognized environmental features during the trip." This is why itineraries vary depending on the point of entry to a shopping centre (Zacharias, 1997; Davies & Dennison, 1977). This is also why pedestrians fail to make minimal paths between destinations, often effecting return trips on the same pathway or circular movements (Gärling and Gärling, 1988). Typically in an underground environment, layout of the whole system is unclear even to regular visitors. As a consequence, visitors rely on visual information obtained by inspecting the corridors in front of them.

At the same time, it is well known that pedestrian movement in underground systems is stable over time and space (Zacharias, 2000). While individuals are responding to their local environment for much of their decisions about local travel, they also tend to agree on paths to take. This knowledge provides the essential foundation for understanding pedestrian movement and eventually predicting flow before construction of new underground links.

Shopping centre managers have a vested interest in attracting and retaining visitors. It is conventional wisdom that the longer a shopper spends in the shopping centre, the more he/she will spend. Managers are often concerned with the uneven distribution of shoppers within their centres and employ various strategies to draw

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pedestrians into less-patronized sectors of the mall. For example, directional signs, colour coding, programmed events and the location of major magnet stores are all typically used to try to move pedestrians around. There is, however, very little empirical evidence on the effectiveness of any one of these strategies; hence the importance of conducting independent studies in support of those strategies.

The developers of underground systems also have an interest in predicting pedestrian flows. Designing a sufficiently large corridor is necessary for comfortable and safe circulation. Very heavy pedestrian flows may result in a loss of business since it is difficult for pedestrians to exit the stream and enter stores or to pay attention to what goods are on offer. Very low pedestrian flows on a large corridor may have the same negative commercial impact. Underground systems often connect a variety of owners and interests, such that detailed negotiations must be conducted for sharing the development costs. The cost share is often evaluated in terms of the potential business value of the corridor.

Thus, observations of pedestrian movement reveal the flow patterns and concentrations, which tend to be quite specific to each centre. While it is exceedingly important to be able to predict these patterns, there remains considerable work to be carried out to reach this goal. Since it is clear that local visual information is an important source of local path decisions, it deserves special attention.

Research on what attracts pedestrians in an enclosed walking system reveals a number of interesting elements. Overall, a certain level of visual complexity is attractive. When this complexity is combined with mystery–for example, hints of larger and interesting spaces just out of view–interest is enhanced and pedestrians are more likely to proceed to that destination (Kent, 1989). Gradual curves in the corridor and spaces that proceed from higher levels to lower rather than the other way around promote exploration (Matsumoto et al, 1997).

Storefront design plays a very significant role in the attraction shoppers feel toward particular centres, while greenery and opportunities for socializing also play a supportive role (Oppewal & Timmermans, 1999). Shoppers are strongly attracted by the presence of other people and evidence of human activity (Zacharias, 2001a). In an experiment conducted using a historic city centre shopping area in Montpellier, France, individuals were asked to make path choices based on photos of the shopping streets. Clear preferences were expressed at nearly every intersection. Then, people, signs, planters and awnings were removed from the most preferred streets and inserted in the least preferred streets. There was a significant increase in preference for the least preferred paths. In the same experiment, preference for paths was positively correlated with certain architectural features such as signs and shop fronts. Overall, however, transitory features such as people walking and signboards were more important in preference than certain architectural features.

A second experiment focused specifically on architectural features of the Montpellier walking environment (Zacharias, 2001b). The aspect ratio was altered in the most and least preferred views. For example, the most preferred views were narrowed or additional floors were added to the buildings, while in the least preferred views, the walking space was widened or the buildings were reduced in height. This is based on early findings that people prefer more spacious walks. In fact, this was the finding here as well.

While these results are preliminary and cover only a limited number of features of walking environments, they do demonstrate that it is possible to uncover environmental factors in pedestrian circulation.

To pursue these questions with regard to an actual pedestrian environment, we conducted an experiment using the Montreal Underground system. In this case, we intended to uncover how people interpreted path choices at intersections in the Underground. Did they see path choices as leading to more shopping choices, greater public activity or alternatively, leading to exit points or dead ends? How did their path choices relate to these interpretations about the available choices? These questions were examined in the following experiment.

Method

In this experiment, we wished to determine how people distinguished between various path choices available to them in a popular pedestrian environment. In the interest of concentrating on visual stimuli and specifically eliminating information about layout, we used sets of photos and drawings. The photos were panoramic views of path intersections in the Montreal Underground.

The Montreal Underground is a well-known underground system with a large number of hallways and walking options. With the exception of several corridors leading to privately owned office buildings, most of the corridors include commercial space. The design of the commercial space varies among the 12 shopping centres, while the corridor width, lighting characteristics and floor materials also vary considerably. These particular elements of corridor design are thought by many designers in Montreal to be quite important in attracting and retaining visitors.

The photos were 35mm photographs taken from a single vantage point at the centre of the intersection and assembled into a single panorama on display boards. Six such intersections were prepared with 3, 5, 5, 6, 6 and 9 path choices, as identified by the participants; that is, we did not tell them where the path were in the views. Some of the paths chosen by participants were not major public paths in the system, but were rather open areas of seating, and food services which might be interpreted as paths or not, but represented, at least to the participants, choices of itinerary within the public part of the malls. Two examples are presented in Figure 1.



Figure 1. Two partial panoramas of two intersections presented to participants.

These six intersections were also presented as line and fill drawings to a second sample of participants. In this case, the original photographic panoramas reduced to lines representing changes in plane, with ceiling, wall and floor planes filled with the same

colour. The line and fill drawings corresponding to the examples presented in Figure 1 are shown in Figure 2.

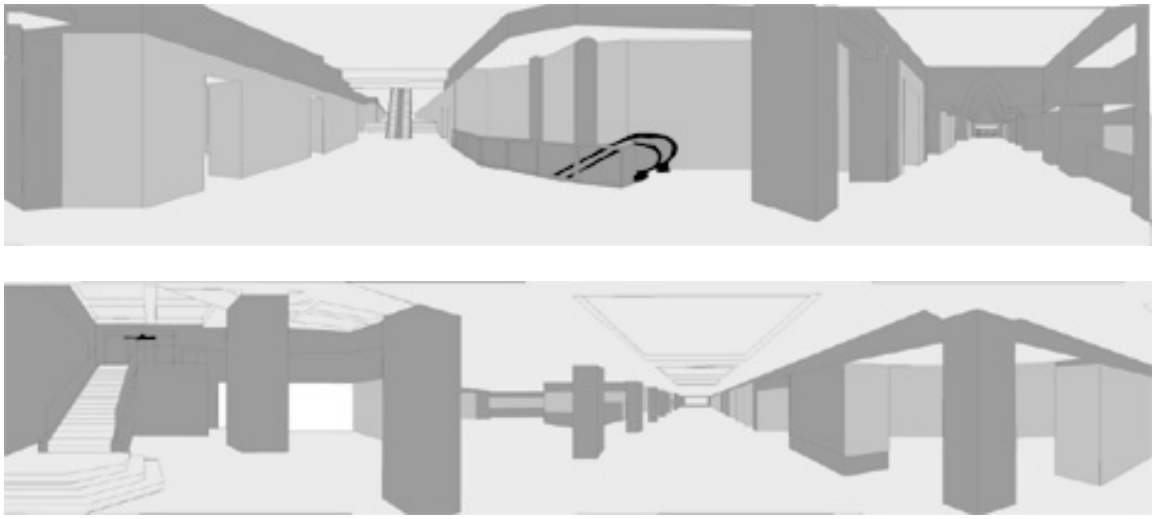


Figure 2. Line and fill drawings of the photo panoramas presented to participants.

Participants were approached in a food mall next to the Central railway station. All of the represented intersections were located at some distance from the food mall. All participants were seated so that the research assistant could present them with the panels and complete the responses on a separate data sheet.

The intention was to discover first of all, whether participants tended to agree on the choice of itinerary and secondly, whether they interpreted the path choices in similar ways.

They were asked to imagine the following scenario: “Pretend you are standing in the intersection as a first time visitor to the mall and you must decide which path to take. The paths you choose could help you get an idea of what is in the mall or lead you to things that you find interesting. We will ask you to tell us your path choices and explain the reasons for these choices.”

The main questions asked were as follows, in order:

1. Which path would you take?
2. Which path leads into the shopping area?
3. Which path leads outside?
4. Which path leads to the greatest number of people?
5. Which path looks like the most interesting walk?
6. Which path leads to more choices of path?

In the photo experiment, 32 individuals participated while 31 individuals took part in the line drawing experiment. While 21 in the photo experiment said they were completely unfamiliar with the locations depicted, 8 said they had some knowledge of the area and 3 said they recognized one or more of the intersections. In the line drawing experiment, only one person said he recognized one intersection while the rest professed to not recognizing the locations. Therefore, we assumed that their prior knowledge of the area did not bias their choices or interpretations of the various pathway options.

Since the panels were presented linearly, it is important to verify whether there might be a left-right or centre-periphery bias; however, we detected no position bias over the participant group. Also, there were 24 women and 39 men participating in the

experiments, varying in age from 18 years old to 55 years old. No significant differences in response were found either by sex or age.

Path preferences

The visual stimuli do represent a range of path characteristics. Certain pathways are clearly defined, straight corridors, some brightly lit, others less so. Certain path options are less well defined, because the edges are angular or open. In certain cases, the path options at the end of the pathway are not visible, while in others, openings ahead, above or to the side suggest access to the outdoors. Also, signs are legible only at close range, since in almost all cases, store signs are of the fascia type.

Table 1. Preferences for pathway choices

Intersection	Pathway										
	1	2	3	4	5	6	7	8	9	χ^2	
A photo	7	1	3	10	5	5				9.49	*
A line	4	4	1	7	7	9				7.78	
B photo	3	14	10	0	3					21.65	***
B line	6	6	7	4	9					2.06	
C photo	3	1	3	4	3	17				33.59	***
C line	9	1	2	2	7	11				16.80	**
D photo	4	15	9	0	2					23.58	***
D line	15	6	7	2	2					17.70	***
E photo	1	0	0	6	2	2	2	2	13	39.59	***
E line	9	3	2	1	9	1	3	0	3	24.90	***
F photo	16	9	4							7.16	**
F line	7	11	14							2.31	

*p<.10; **p<.05; ***p<.01

Distinct preferences for certain paths could be detected in both the photo and line drawing sets, although distinct differences could not be established for all sets, as shown in Table 1. Of the photos, all but one reveal highly significant preference. Of the line drawings, three reveal significant preference.

There is little relationship between the preferences for the photos and the preferences for the line drawings. A non-significant r of .303 between the preferences for the two sets was calculated.

What can be said about the specific path preferences? While a post hoc interpretation of the revealed preferences has dubious scientific value, it is of interest for future experiments. It is also of considerable value to designers who are often charged with ‘fixing’ perceived problems with Underground corridors; that is, they need to know how people react to their design solutions.

Figure 3 shows two paths that were highly preferred. In the image on the left, there are people, evident path options and the suggestion that the corridor leads to other spaces. In fact, the corridor does not lead to other spaces but merely to an exit. The image on the right was highly preferred over other corridor options where the decorative ceiling fixtures are absent. At another intersection in this particular shopping mall, the same decorative features appear to be partly responsible for strong attraction to that corridor. Interestingly, these features were recently removed as part of a renovation scheme

designed to improve overall patronage at the mall. The architects reasoned that the features were architecturally questionable. Based on this study, we would suggest that they were nevertheless popular and had nothing to do with low sales figures in this part of the Underground.



Figure 3. Highly popular path choices: On the left is a corridor in Place Ville-Marie, while on the right is a corridor in Place de la Cathédrale, recently renovated and no longer having the floor, ceiling and lighting features depicted in this photograph.

In Figure 4, two rather unpopular path options are depicted. In the example on the left, enhanced lighting, large storefronts and animated displays in the shop windows were thought by the designers to enhance path choice. However, people viewing the paths drew attention to what appeared to be a blank wall at the end of the corridor with no obvious means of continuing the trip. In fact, there is a way through, although a level change makes this rather hard to see from the intersection. In the example in Figure 4 on the right, there are two path options in the centre of the image. The escalator suggests movement up. Daylight coming from above further suggests this as a means to leave the mall and so was not selected by participants. The other path option, to the right of the escalator is a zig-zag with no clear delineation. Participants rejected similar path options in other intersections.



Figure 4. The path on the left is in Place Montréal-Trust while the two paths in the centre of the image on the right are in Place Ville-Marie. All were rejected as attractive path options.

Interpretation of path choices

There was substantial agreement among the participants with regard to the interpretation of choices at certain intersections, but not at others. Intersections C, D and

E represented clear choices for participants whereas there was generally less agreement on how to interpret intersections B and F, in particular.

Table 2 shows the X^2 statistics for questions and choices by intersection.

Table 2. The interpretation of path choices from photo set

Intersection	Question				
	2	3	4	5	6
A	40.5***	34.9***	14.2**	8.5	12.3**
B	0.5	3.9	15.5***	10.2**	5.8
C	19.1***	12.3**	20.9***	22.5***	17.5***
D	27.1***	16.1***	28.9***	24.2***	14.6***
E	46.2***	36.1***	23.2***	23.7***	28.2***
F	4.8*	0.25	8.7**	1.75	8.3**

*p<.10; **p<.05; ***p<.01

Similarly, there was substantial agreement among the participants as to the interpretation of paths from the line drawings. Table 3 presents the statistics for questions and choices by intersection for these stimuli.

Table 3. The interpretation of path choices from the line drawing set

Intersection	Question				
	2	3	4	5	6
A	10.1*	36.0***	20.4***	17.7***	16.5**
B	10.6**	14.5***	4.1	6.0	9.5**
C	28.3**	14.9**	33.4***	76.8***	18.5***
D	14.8	40.9	20.1	27.2***	17.8***
E	20.0**	20.0**	29.5***	67.2***	24.9***
F	8.8**	1.9	8.4**	6.2**	5.1**

*p<.10; **p<.05; ***p<.01

Evidently, the line drawings were interpreted somewhat differently from the photos when asked questions about the meaning of the visual information. The selections were different among the line drawings, yet participants tended to agree at least to the same degree as for the photos.

There is substantial agreement between free choices for exploration and specific choices related to the meaning of each path. This is as true for the photo set as for the line drawing set. In both cases, the highest correlation is for paths leading to more people. Interesting walks and walks leading to more path choices also showed significant and strong correlation, as shown in the following Table 4.

Lastly, we analysed the statements made by a sample of participants as they interpreted the various path options and justified their choices. Their comments with regard to each path option were taken down verbatim and analysed qualitatively. There was a total 652 clear statements. The statements were then classified by key words, working with equivalents in French, the dominant language of response, and English. It is important to note that the responses were entirely free, although the participants were encouraged to verbalise their observations. Table 5. summarises the major keyword categories and the number of ‘hits’ for each.

Table 4. The relationship between free path choice and the interpretation of paths

Set	Question	R	R2	F-value	p-value
Photos 2		.752	.565	41.65	<.0001
	3	not significant			
	4	.568	.323	15.25	.0005
	5	.907	.822	148.17	<.0001
	6	.717	.514	33.8	<.0001
Lines	2	.868	.754	97.9	<.0001
	3	not significant			
	4	.790	.624	53.15	<.0001
	5	.866	.750	96.09	<.0001
	6	.669	.447	25.87	<.0001

In keeping with the other findings in this research, qualities of place predominate the comments. Most such comments concern the presence of people, the apparently liveliness of the space and the variety and interest of the shops. Corridor width also accounts for a substantial number of comments along with the legibility of the path.

Table 5. Most frequently mentioned comments concerning path options by category of comment (n= 503; total=652)

Category	Number of comments
Qualities of place (lively, warm, interesting, dead)	191
Width of corridor or size of space	103
Colour	57
Legibility of architectural space	55
Lighting level or quality	50
Ceiling height	38
Length of corridor	9

Conclusions

People have clear interpretations about the meanings of paths in a shopping environment. The presence of people, central area, diversity of choice and the interest presented by the spaces themselves can all be intuited from photos and line drawings. The interpretation given to the path choices tend to agree on these criteria with free choice when exploring the mall.

Isolating the geometry of the spaces and removing all other visual information still produced quite strong opinions about the nature of the spaces and free choice. However, generally lower correlation between photos and line drawings strongly suggest that people are gleaning different information from the photos than from the line drawings. This finding is consistent with our earlier research, where people were clearly scanning the views for relevant information about the activities taking place in those pedestrian corridors. When other people, tables, signs and objects on display are absent, people interpret the space differently and make different path choices.

What do the selections tell us about people's preferences for exploration in an Underground shopping mall? It is apparent from this study and from other recent studies that temporal aspects of the space are as important if not more important than the

architectural design. The presence of people and liveliness in general appear to be the most important factor in drawing people. On the other hand, certain architectural features did dampen interest in visiting certain corridors.

This study was preliminary in nature. It served to demonstrate the technique for determining public preference as well as the sample size required for statistical power. Design issues that are much less clear could be addressed using these techniques–for example, the use of colour, lighting levels and sources, surface materials and furniture in the public space.

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