

Mall Users' Perceived Relative Importance of the Different Wayfinding Design Factors

Haidy M. El-Hassawi*, Yasser M. Moustafa, Sherif M. El-Fiki

Department of Architectural Engineering and Environmental Design, Arab Academy for Science, Technology and Maritime Transport, Egypt

Received January 22, 2023; Revised April 4, 2023; Accepted May 9, 2023

Cite This Paper in the Following Citation Styles

(a): [1] Haidy M. El-Hassawi, Yasser M. Moustafa, Sherif M. El-Fiki, "Mall Users' Perceived Relative Importance of the Different Wayfinding Design Factors," *Civil Engineering and Architecture*, Vol. 11, No. 4, pp. 2149 - 2160, 2023. DOI: 10.13189/cea.2023.110434.

(b): Haidy M. El-Hassawi, Yasser M. Moustafa, Sherif M. El-Fiki (2023). *Mall Users' Perceived Relative Importance of the Different Wayfinding Design Factors*. *Civil Engineering and Architecture*, 11(4), 2149 - 2160. DOI: 10.13189/cea.2023.110434.

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Abstract The objective of the study is to investigate, in the Egyptian context, mall users' perceived relative importance of the different wayfinding design factors emphasized in literature. The study relied on an online survey questionnaire which first asked respondents to rate, based on their experience of shopping malls in general, the importance of each of seven wayfinding factors. Then, respondents were asked to indicate among three shopping malls of different layout designs all located in the Greater Cairo Area the one they were most familiar with. The remaining of the questionnaire inquired more specifically about respondents' perceptions of the different wayfinding factors in the mall chosen. Results indicate that "landmarks" is perceived as the most important wayfinding design factor followed by "the subdivision of the mall in distinct zones" and "directional signs". However, results also show differences between genders and between users of different levels of familiarity with the mall in terms of the perceived relative importance of the seven wayfinding factors investigated. The complexity of the mall layout and circulation pattern was also found to affect the perceived relative importance of the different factors. Implications for better wayfinding design are discussed in the conclusion of the article.

Keywords Wayfinding, Shopping Malls, Architectural Design Factors, Egypt

1. Introduction

According to the relevant literature, shopping mall designs should address a wide range of issues. The design of malls should satisfy users' needs and varying objectives [1] and should consider the location, aesthetics, facilities, services [2], the kind of set up and display, accessibility, and wayfinding[3]. Wayfinding in shopping malls is the focus of the research study presented in the article.

Wayfinding is the process of moving within the environment with the intention of arriving at a specific destination [4], [5]. According to Lynch [4], in this process, people rely on the consistent use and organization of sensory cues from the surrounding environment. With the help of these cues, they create mental maps on which they rely in their navigation within the environment.

As explained by Passini [6], the creation of mental maps or cognitive mapping is the first step in the wayfinding process. Individuals capture information to try to comprehend the surrounding environment and create accurate mental maps. The following two steps, decision-making and decision execution, are fundamentally dependent on the information collected and the mental maps created. Several factors impact the accuracy of mental maps and thus the success of the wayfinding process. These factors include both the environmental factors (characteristics of the environment) and personal factors (characteristics of the individual) [6], [7].

Wayfinding research has originally tended to focus on the urban environment [4]. However, today, wayfinding is also being studied within buildings such as hospitals [8], airports [9], [10], educational buildings [11], [12], and shopping malls [3], [9], [13]–[15].

Wayfinding issues are particularly important for shopping malls [3]. No matter the reason a person is visiting a mall, to shop at a particular store, to meet friends, or just to stroll around, he or she has to make wayfinding decisions related to movement through the building [16]. Designing malls for better wayfinding contributes to a more enjoyable user experience [15]. It provides for an easier flow of movement for users. It also reduces uncertainty and disorientation and allows users to reach their desired destination quickly and with minimum effort. In turn, this results in a more pleasant experience and a higher degree of environmental satisfaction [13], [17], [18].

Shopping mall developers have learned that effective wayfinding practices have great marketing benefits [19]. Research demonstrates that a shopping mall's attractiveness depends on the ease of wayfinding [14]. Visitor satisfaction with wayfinding in a mall is positively correlated with the popularity of the establishment [15].

As further discussed in the following section, a large amount of research has identified different factors affecting wayfinding in shopping malls. These factors are typically divided into personal characteristics and design or environmental factors. However, to date, there has been very limited research on mall users' actual perceptions about the relative importance of each of the design factors as a wayfinding aid, particularly in the Egyptian context. A better understanding of the relative importance of the different wayfinding design factors from the point of view of mall users can certainly contribute to the knowledge needed to design for improved wayfinding in shopping malls.

Accordingly, the objective of this study is to investigate mall users' perceived relative importance of the different wayfinding design factors identified in the literature and extract recommendations for better wayfinding design.

2. Wayfinding Factors in Shopping Malls

Like for other building types, factors affecting wayfinding in shopping malls are categorized into personal characteristics and design or environmental factors. Personal characteristics reported to affect wayfinding include age, gender, occupation, and familiarity with the environment [3], [17], [20]–[24]. On the other hand, the design or environmental factors that are related to wayfinding in malls include directional aids, landmarks, a pattern of circulation network, distinctiveness between zones, and visual continuity [3], [13], [17], [19], [20], [25]. These design factors were identified through an extensive analysis of the relevant research literature and are further

discussed below.

2.1. Directional Aids

Directional aids include directional signs, mall maps and verbal descriptions. These aids or tools could be thought of as information support systems for wayfinding and could contribute to affective wayfinding [26], [27]. Shoppers often rely on these navigational aids to reach particular destinations [15].

Directional signs provide directional information about specific locations. For effectiveness, directional signs need to be well-placed such as at nodes or decision points. They also need to be readable, clear, and basic in design with the minimum amount of information needed [9], [13], [28], [29].

Mall Maps can be useful navigation aids. They can be presented in different forms. They can be in the form of large scale diagrams placed in or around the building. They can be interactive electronic maps located at strategic locations within the mall. They can also be printed on portable pamphlets. And, increasingly, they can be accessed through online applications [9]. Effective mall maps need to be easy to read, provide sufficient information, and clearly show paths, landmarks, and different mall zones [13].

Verbal descriptions can also be an important wayfinding aid. They include the different types of information that can be conveyed orally by information booth employees, security guards, and other mall users when asked about a particular destination [3].

2.2. Landmarks

Landmarks have been emphasized as important wayfinding aids both in the urban environment and within complex buildings [4], [13], [17], [30], [31]. Landmarks are easily identifiable elements of the environment that are used as significant points of reference. They tend to be commonly known and are generally characterized by distinctive features or particular symbolic means [32]–[36]. In shopping malls, landmarks act as anchor points and can include particular stores, works of art, the location of escalators or elevators, the intersection of main paths, or atriums [3], [13].

2.3. Pattern of Circulation Network

The literature emphasizes the pattern of circulation network as an important design factor related to wayfinding. In certain studies this factor is discussed in terms of building configuration [20]. The circulation network, including paths, intersections of paths or nodes, and points of vertical circulation is a very important component of the mental maps that people create to help them navigate within the environment [3], [19], [27]. Patterns of circulation networks used in the design of shopping malls generally follow one of a number of

proto-typical patterns: (1) linear, (2) grid, (3) radial, (4) loop or donut, or (5) composite [3], [6], [19], [27]. According to the research literature, certain patterns of circulation networks permit, more than others, the creation of accurate mental maps and easier wayfinding. In particular, according to [37], linear circulation patterns are associated with easier wayfinding than donut patterns. On the other hand, donut patterns are associated with easier wayfinding than composite patterns.

2.4. The Distinctiveness between Zones

Within malls and other types of complex buildings, the distinctiveness between the different zones of the building is an aspect that can significantly facilitate wayfinding [20]. Perceived design differences between various building zones or areas help improve orientation as people can more easily map spatial entities if they are distinct from their surroundings [19], [20], [38]. The form and volume of spaces and ornaments can be used to create this distinctiveness, as can the use of different finishes, colors, graphics, and lighting design [15], [39], [40].

2.5. Visual Accessibility

Visual continuity or visual accessibility is an important aspect of the built environment related to wayfinding [41], [42]. Visual continuity entails the ability to look ahead, that is, to see one's destination before actually getting there [20]. Obviously, it is easier to navigate a given environment if the destination is in sight. On the other hand, according to Garling et al. [25], reduced visual continuity has a negative impact on orientation and one's capacity to navigate. Research studies have confirmed the importance of visual continuity within buildings for wayfinding [22], [25], [43]–[45]. In buildings, visual continuity refers to both horizontal visual accessibility, for example through the use of wide straight corridors, and vertical visual accessibility between floors, for example through the use of atriums.

Table 1. Wayfinding Factors in Shopping Malls

Directional Aids	Legibility	Visual Continuity
Directional Signs	Landmarks	
Mall Maps	Circulation Network	
Verbal Description	Distinctiveness Between Zones	

3. Methods

3.1. Research Design

As previously mentioned, the objective of the study was to investigate mall users' perceived importance of the different factors affecting wayfinding in malls identified in the literature: (1) directional signs, (2) mall maps, (3)

verbal description, (4) landmarks, (5) circulation network pattern, (6) distinctiveness between mall zones, and (7) visual continuity. The study relied on an online survey questionnaire. The questionnaire first asked respondents to rate, based on their experience of shopping malls in general, the importance of each of the seven wayfinding factors. Then, respondents were asked to indicate among three shopping malls located in the Greater Cairo Area the one they were most familiar with. These three malls were selected to be of similar type and scale but different in terms of layout design and circulation network pattern. The remaining questionnaire included questions that inquired about respondents' perceptions and opinions about the seven wayfinding factors more specifically in relation to the mall chosen.

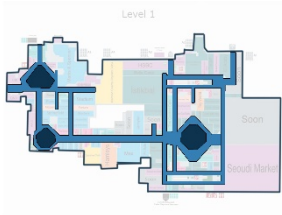
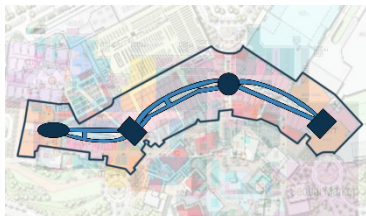
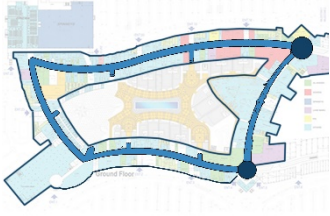
3.2. The Three Malls Selected for the Study

The three malls selected for the design of the questionnaire were City Stars Mall (CS), Cairo Festival City Mall (CFC), and Mall of Arabia (MA). The three malls are located in the Greater Cairo Area and are among the largest malls in Egypt. They can be all categorized as Super Regional Malls [46]–[48]. This particular type of mall was considered because, due to their scale, wayfinding issues are more significant than in smaller malls. The three malls are very similar in total area (see Table 2). On the other hand, the three malls are different in terms of layout design and circulation network pattern. CS is characterized by an eight-floor composite layout design, CFC is characterized by a three-floor linear layout design and MA is characterized by a single-floor donut layout design.

3.3. Design of Survey Questionnaire

The online questionnaire form clearly explained the objectives of the study and assured of the complete anonymity of responses. The questionnaire was designed in two main parts. In the first part, a number of questions inquired about the relevant socio-demographic characteristics of respondents such as age, gender, occupation, and the frequency with which they typically visit shopping malls. Then, based on their experience with malls in general, respondents were asked to rate on a five-point Likert scale the importance of the seven wayfinding factors investigated. Finally, respondents were asked to select, among CS, CFC, and MA the mall they were most familiar with to answer the questions of the second part. In the second part, questions first asked respondents about their familiarity with the selected mall. Then, the remaining questions of this second part inquired about perceptions and opinions of respondents about the seven wayfinding factors more specifically in relation to the particular mall chosen. An earlier version of the questionnaire was pilot-tested in September 2021. This led to the clarification of some of the questions in the final version.

Table 2. The Three Malls Selected for the Study

Malls	City Stars Mall (CS)	Cairo Festival City Mall (CFC)	Mall of Arabia (MA)
Floor Plan and Circulation			
Layout Type	Composite	Linear	Donut
Total Area	151,000 m ²	158,000 m ²	150,000 m ²
Year of Construction	2004	2013	2010
Location	Heliopolis	New Cairo	6 th of October City
Number of Levels	8	3	1

3.4. Sampling and Respondents Characteristics

Sampling relied on a combined convenience and snowball sampling approach. The internet link of the questionnaire was e-mailed first to a number of friends, co-workers, and acquaintances, who, in turn forwarded the questionnaire link to their own relatives, friends, co-workers, and acquaintances. The questionnaire link was also posted on a social media platform. A total of 200 participants responded in a span of two weeks in October and November 2021. Table (3) presents the main characteristics of the respondents.

3.5. Data Analysis

The data collected was analyzed using IBM, SPSS statistical software, Version 22. Descriptive statistics were used to organize the data and investigate mean values and frequency distributions. A number of inferential statistical tests were also used. T-test and ANOVA were used to investigate differences between means. Spearman correlation and Linear Regression were used to investigate correlations.

4. Results

4.1. Perceived Importance of Wayfinding Factors

The questionnaire investigated the respondents' perceived importance of each of the seven wayfinding

factors that were extracted from the relevant literature. Using a five-point scale, based on their experience with malls in general, the question asked respondents to rate how important they thought each of the factors to be in helping them find their way in malls. As shown in figure (1), for respondents as a whole, rating mean was highest for landmarks (3.77), followed by the subdivision of the mall in clearly distinct zones (3.71), directional signs (3.64), clarity of circulation network (3.52), visual continuity (3.46), mall maps (3.26), and finally, verbal description (3.09).

Table 3. Main Characteristics of the Respondents

Characteristics		n (%)
Gender	Males	64 (32%)
	Females	136 (68%)
Age	Less than 20	10 (5%)
	21-30	85 (42.5%)
	31-40	64 (32%)
	41-50	26 (13%)
	51-60	7 (3.5%)
	60 +	8 (4%)
Chosen Mall	City stars Mall	68 (34%)
	Cairo Festival City Mall	100 (50%)
	Mall of Arabia	32 (16%)

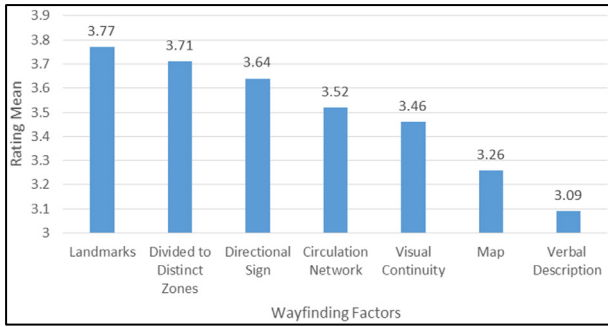


Figure 1. Perceived Importance of Wayfinding Factors (Respondents as a whole)

4.1.1. Differences in Relation to Gender

For each of the seven wayfinding factors investigated, there was no significant difference between male and female respondents in mean rating of perceived importance. However, there was a difference between genders in the order of the means, from greatest to smallest. As shown in Table (4) for males, mean rating of perceived importance

as a wayfinding aid was highest for directional signs (3.63), followed by the subdivision of the mall in clearly distinct zones (3.58), landmarks (3.56), visual continuity (3.41), maps (3.39), clarity of circulation network (3.38), and finally, verbal description (3.11). In contrast, for females, mean rating of perceived importance was highest for landmarks (3.86), followed by the subdivision of the mall in clearly distinct zones (3.77), directional signs (3.65), clarity of circulation network (3.59), visual continuity (3.49), maps (3.19), and finally verbal description (3.08).

4.1.2. Differences in Relation to the Three Malls

For each of the seven wayfinding factors, results do not show any significant difference between CS, MA, and CFC respondents in mean rating of perceived importance. However, as shown in Table (5) there was a difference between CS, MA, and CFC respondents in how means ranked from greatest to smallest.

Table 4. Difference in Ranking of Perceived Importance of Wayfinding Factors between Males and Females

Males (n=64)			Females (n=136)		
Rank	Wayfinding Factors	Rating Mean	Rank	Wayfinding Factors	Rating Mean
1	Directional Signs	3.63	1	Landmarks	3.86
2	Divided into Different Zones	3.58	2	Divided into different Zones	3.77
3	Landmarks	3.56	3	Directional Signs	3.65
4	Visual Continuity	3.41	4	Circulation Network	3.59
5	Maps	3.39	5	Visual Continuity	3.49
6	Circulation Network	3.38	6	Maps	3.19
7	Verbal Description	3.11	7	Verbal Description	3.08

Table 5. Difference in Ranking of Perceived Importance of Wayfinding Factors between the Three Chosen Malls

Citystars (n=68)		Mall of Arabia (n=32)		Cairo Festival City Mall (n=100)	
Rank	Wayfinding Factors	Rank	Wayfinding Factors	Rank	Wayfinding Factors
1	Landmarks	1	Divided into Different Zones	1	Landmarks
2	Divided into Different Zones	2	Directional Signs	2	Directional Signs
3	Circulation Network	3	Landmarks	3	Divided into Different Zones
4	Visual Continuity	4	Circulation Network	4	Circulation Network
5	Directional Signs	5	Visual Continuity	5	Visual Continuity
6	Maps	6	Verbal Description	6	Maps
7	Verbal Description	7	Maps	7	Verbal Description

For CS respondents, mean rating of perceived importance as a wayfinding aid was highest for landmarks (3.75), followed by the subdivision of the mall in clearly distinct zones (3.69), circulation network (3.57), visual continuity (3.54), directional sign (3.38), maps (3.25), and verbal description (3.16). For MA respondents, mean rating of perceived importance was highest for the subdivision of the mall in clearly distinct zones (3.75), followed by directional signs (3.72), landmarks (3.66), circulation network (3.44), visual continuity (3.34), verbal description (3.25), and maps (3.06). Finally for CFC respondents mean rating of perceived importance was highest for landmarks (3.81), followed by directional signs (3.79), the subdivision of the mall in clearly distinct zones (3.71), circulation network (3.51), visual continuity (3.44), maps (3.32) and finally, verbal description (2.99).

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

4.1.3. Differences in Relation to Reported Familiarity with the Malls

Respondents as a whole were divided into two groups according to their reported familiarity with the mall they selected to answer the second part of the questionnaire (CS, MA, or CFC). They were divided into low familiarity respondents (ratings of 1 to 3) and high familiarity respondents (ratings of 4 or 5). Again, there was no significant difference between low and high familiarity respondents in mean rating of perceived importance for the

seven factors investigated. There was, however, as shown in Table (6), a difference between low and high familiarity respondents in the ordering of mean values. For low familiarity respondents, mean rating of perceived importance was highest for the subdivision of the mall in clearly distinct zones (3.72) and lowest for maps (2.70). As for high familiarity respondents, mean rating of perceived importance was highest for landmarks (3.89) and lowest for verbal description (3.06).

4.1.4. Differences in Relation to Reported Ease of Wayfinding in the Malls

As anticipated, the difference in the layout design of the three malls selected was found to be associated with the difference between the malls in mean ratings of ease of wayfinding. For MA (donut layout design), the mean was 4.25 and was clearly greater than for the two other malls. For CFC (linear layout design), the mean was 3.78 and, for CS (composite layout design), the mean was 3.72. A one-way ANOVA test showed that these differences between respondents of the three malls in ratings of ease of wayfinding were indeed significant [$F(2, 197) = 3.57, p = 0.03$].

Respondents as a whole were divided into two groups according to their ratings of ease of wayfinding in the mall they selected to answer the questionnaire: lower ease of wayfinding respondents (ratings of 1 to 3) and higher ease of wayfinding respondents (ratings of 4 or 5). There was no significant difference between lower and higher ease of wayfinding respondents in mean rating of perceived importance for the seven wayfinding factors investigated.

Table 6. Difference in Ranking of Perceived Importance of Wayfinding Factors between Respondents Familiarity with Malls

Reported Familiarity with Malls: Low Familiarity (n=44)		Reported Familiarity with Malls: High Familiarity (n=154)	
Wayfinding Factors	Rating Mean	Wayfinding Factors	Rating Mean
1 Divided into Different Zones	3.72	1 Landmarks	3.89
2 Directional Signs	3.46	2 Divided into Different Zones	3.72
3 Circulation Network	3.45	3 Directional Signs	3.69
4 Landmarks	3.36	4 Circulation Network	3.62
5 Visual Continuity	3.19	5 Visual Continuity	3.51
6 Verbal Description	3.12	6 Maps	3.36
7 Verbal Description	3.11	7 Verbal Description	3.08

Table 7. Difference in Ranking of Perceived Importance of Wayfinding Factors between Respondents Ease of Wayfinding in Malls

Reported Ease of Wayfinding: Low Ease of Wayfinding (n=71)			Reported Ease of Wayfinding: High Ease of Wayfinding (n=129)		
Wayfinding Factors	Rating Mean		Wayfinding Factors	Rating Mean	
1 Divided into Different Zones	3.89	1	Landmarks	3.82	
2 Visual Continuity	3.72	2	Divided into Different Zones	3.71	
3 Landmarks	3.65	3	Directional Signs	3.66	
4 Circulation Network	3.59	4	Visual Continuity	3.44	
5 Directional Signs	3.53	5	Circulation Network	3.40	
6 Verbal Description	3.48	6	Maps	3.34	
7 Maps	3.06	7	Verbal Description	3.02	

There was, however, as shown in Table (7), a difference between lower and higher ease of wayfinding respondents in how means ranked from greatest to smallest. For lower ease of wayfinding respondents, mean rating of perceived importance was greatest for the subdivision of the mall in clearly distinct zones (3.89) and smallest for maps (3.06). As for higher ease of wayfinding respondents, mean rating of perceived importance was greatest for landmarks (3.82) and smallest for verbal description (3.02).

4.2. Directional Signs

As mentioned above, participants as a whole ranked directional signs third in terms of perceived importance among the seven wayfinding factors investigated (see Figure 1). Results suggest that ratings of the perceived importance of directional signs are influenced by how often participants actually use them as a directional aid. Indeed, results of the Spearman's Roh test show a significant positive correlation between the perceived importance of directional signs and ratings of how often they are used [$r_s(198) = 0.50, p < 0.001$]. In turn, how often directional signs are used as a wayfinding aid appears to be related to design aspects of the directional signs. Results show significant positive correlations between how often directional signs are used and ratings of each of how easy they are to read / understand [$r_s(198) = 0.40, p < 0.001$] and how well they are placed [$r_s(198) = 0.33, p < 0.001$].

Differences in mean ratings between the CS, CFC, and MA participants provide further confirmation. These differences suggest that directional signs in CS are not as successfully designed as in CFC and MA and, consequently, less often used as a wayfinding aid. For CS participants mean ratings of how often directional signs are used (2.97), how easy they are to read / understand (3.63), and how well they are placed (2.88) were consistently lower than mean ratings of participants from CFC (3.48, 3.83, 3.30 respectively) and MA (3.38, 4.06, 3.44 respectively). A one-way ANOVA test actually yielded significant differences between the three groups of

participants in terms of mean ratings of how often directional signs are used [$F(2,197) = 3.16, p = 0.045$] and how well they are placed in the three malls [$F(2,197) = 3.87, p = 0.022$]. Furthermore, in terms of perceived importance, CS participants only ranked directional signs fifth among the seven-wayfinding factors investigated. In contrast, both CFC and MA participants ranked them second (see Table 5).

4.3. Mall Maps

Participants as a whole only ranked maps sixth in terms of perceived importance among the seven-wayfinding factors investigated (see Figure 1). Moreover, as for directional signs, results suggest that the perceived importance of mall maps as a wayfinding aid is affected by how often participants actually rely on them. The Spearman's Roh test conducted shows a significant positive correlation between ratings of the perceived importance of mall maps as a directional aid and ratings of how often they are used [$r_s(198) = 0.47, p < 0.001$]. Subsequently, how often maps are used as a wayfinding aid appears to be related to design aspects of the maps. Results show significant positive correlations between how often maps are used and ratings of each of how easy they are to read / understand [$r_s(198) = 0.50, p < 0.001$] and how well they are placed [$r_s(198) = 0.28, p < 0.001$].

Mean ratings for how well mall maps are located and for how easy they are to read / understand were greater for MA (3.16 and 3.81) than for CS (2.91 and 3.72). Interestingly, however, mean ratings for how often mall maps are used and for how useful they are were greater for CS participants (3.31 and 3.93) than for MA participants (2.94 and 3.69). This apparent greater use of mall maps as a directional aid in CS could be related to the lower reliance on directional signs as reported in the previous section, and / or to the relative complexity of the layout design and circulation pattern in that particular mall (mean ratings for ease of wayfinding were 3.72 for CS but 4.25 for MA). In fact, according to ratings of participants, asking someone

for directions also appears to be relied on more often and to be more useful in CS (3.10 and 3.68) than in MA (2.81 and 3.34).

4.4. Landmarks

Respondents as a whole considered landmarks as the most important wayfinding aid, ranking it first in terms of perceived importance among the seven wayfinding factors investigated (see Figure 1). Ratings of the perceived importance of landmarks were found to be significantly correlated to how useful they are as a wayfinding aid in the three malls, CS, CFC, and MA [$r_s(198) = 0.19, p = 0.006$]. Mean ratings for how useful landmarks are as a wayfinding aid were greater for CS and CFC (4.12 and 4.10 respectively) than for MA (3.94). This could be related to the relative ease of wayfinding in MA (4.25) compared to CS (3.72) and CFC (3.78). MA participants only ranked landmarks third in terms of importance among the seven wayfinding factors investigated. In contrast, CS and CFC participants viewed landmarks as the most important wayfinding aid (see Table 5).

The questionnaire asked respondents to indicate what they considered to be the main landmarks in the particular mall they had selected. Responses most frequently mentioned specific stores, often anchor stores ($f = 199$), particular functional zones such as “food court”, “restaurant area”, “recreational zone”, and “kids zone” ($f = 99$), different types of services such as “toilets”, “prayer area”, “ATM machines”, “information booth” and “escalators and elevators” ($f = 12$) and a specific entrance ($f = 9$). Interestingly, architectural features that could function as landmarks (such as “statue”, “sculpture”, “fountain”, “huge chandelier in atrium”, “piece of artwork”, “flooring pattern at specific locations”) were not frequently mentioned ($f = 8$) and were only mentioned by CS participants.

4.5. Circulation Network

As expected, the different circulation network patterns for the three malls selected led to differences in mean ratings for how easy it is to understand the circulation network, although the differences in mean ratings were not found to be statistically significant. The mean was the highest for CFC, which is characterized by a linear circulation network pattern (3.67). It was slightly lower for MA with its donut circulation pattern (3.56). It was the lowest for CS which is designed with a composite layout and complex circulation network pattern (3.34).

As shown in Figure (1), participants as a whole only ranked the ability to understand the circulation network fourth in terms of perceived importance among the seven wayfinding factors investigated. However, it appears that this factor remains an important wayfinding factor. Indeed, results show a significant positive correlation between respondents' ratings of how easy it is to understand the

circulation and ratings of ease of wayfinding in the three malls [$r_s(198) = 0.45, p < 0.001$].

4.6. Subdivision of the Mall in Clearly Distinct Zones

The subdivision of the mall in clearly distinct zones appears to be considered as an important wayfinding aid. As previously mentioned, respondents as a whole ranked it second in terms of importance among the seven wayfinding factors investigated. Ratings of the perceived importance of the clarity of the subdivision of the mall into zones were found to be significantly correlated with ratings of how useful it is as a wayfinding aid in the three malls [$r_s(198) = 0.26, p < 0.001$]. Mean ratings for how useful the clarity of the subdivision of the mall into zones is as a wayfinding aid were greater for CFC and CS (3.79 and 3.75 respectively) than for MA (3.71). This could be because MA is less clearly divided into distinct zones than the two other malls. Indeed, mean ratings for how clearly the mall is subdivided into zones were (3.19) for MA but (3.41) and (3.40) for CS and CFC. It could also be because of the relative ease of wayfinding in MA (4.25) compared to CS (3.72) and CFC (3.78), making the subdivision of the mall into distinct zones a less useful wayfinding aid in that particular mall.

Respondents were asked to choose among a number of options to indicate what they considered to distinguish the different zones in their selected malls. The great majority of respondents selected “function / type of stores” ($f = 139$). Very few selected “architectural design or treatment” ($f = 27$). In a follow – up question, respondents were asked to indicate what they considered to be distinct zones in their selected malls. Answers clearly tended to refer to functional zones such as “a zone of particular type of stores” ($f = 99$), “the food court” ($f = 47$), “a café or restaurant zone” ($f = 22$), “the recreational zone” ($f = 22$), and “the cinema area” ($f = 14$). Interestingly, none of the answers referred to architectural design or architectural treatment.

4.7. Visual Continuity

As shown in Figure (1), respondents as a whole only ranked visual continuity fifth in terms of importance among the seven wayfinding factors investigated. The mean rating for how useful visual continuity was for wayfinding was lower for MA respondents (3.66) than for CS and CFC respondents (3.82 and 3.85 respectively). This could be explained by the relatively low visual continuity afforded by the single floor and donut circulation pattern design of MA. Like for landmarks and the subdivision of the mall in clearly distinct zones, this could also be explained by the greater ease of wayfinding in MA compared to CS and CFC as expressed by ratings of respondents.

The questionnaire asked respondents to identify actual places in their selected malls that allow good visual continuity. MA respondents tended to indicate the food

court and the outdoor area, which share the area at the center of the mall. In contrast, CS and CFC respondents tended to point to long and wide corridors and intersections between them as well as vertical openings allowing visual continuity between floors (atriums and escalators).

5. Discussion and Conclusion

As previously mentioned, the design of shopping malls needs to address a range of important issues including location, aesthetics, facilities, services and wayfinding. This last issue is the focus of this research study.

The literature emphasizes a number of wayfinding factors to consider in the design of shopping malls. This study investigated the relative importance of these different wayfinding factors as perceived by mall users. Results not only indicate how mall users ranked the seven wayfinding factors investigated in terms of importance, they also begin to provide design suggestions for improved wayfinding.

In this study, respondents as a whole perceived landmarks as the most important of the seven wayfinding factors in shopping malls investigated. Indeed, much of the wayfinding literature emphasizes the importance of landmarks [4], [13], [17], [30], [31], [34]. However, results of the study also show gender differences in relation to the perceived importance of landmarks. While females ranked landmarks as the most important of the factors, males only ranked it third after directional signs and the subdivision of the mall in clearly distinct zones. This appears to be consistent with previous studies that show that women recall and rely on landmarks more than men [49], [50]. The perceived importance of landmarks was also found to vary according to the reported familiarity with the mall. Respondents reporting high familiarity ranked landmarks as the most important of the factors. On the other hand, respondents reporting low familiarity only ranked landmarks fourth after the clear subdivision of the mall into zones, directional signs, and pattern of circulation network. While this is consistent with the findings of Chebat et al. [49], it appears to contradict those of Li et al. [51], according to which the need for landmarks gradually decreases with increased familiarity. In addition, results of the present study show that both the perceived importance and the reported usefulness of landmarks as a wayfinding aid tend to increase when wayfinding in the mall is viewed as more difficult (such as in CS) and tend to decrease when wayfinding is viewed as less difficult (such as in MA).

Respondents of the three malls tended to indicate specific stores (often anchor stores) or particular functional zones (such as the food court or the recreational zone) as what they considered to be the main landmarks. Although the literature often emphasizes that distinct spatial features (distinct by their colors, shapes, or semantic values) can be important landmarks [4], [52], very few of the respondents of this study referred to architectural features as main

landmarks in the malls. This could be because mall users are more inclined to rely on the location of stores in the construction of their mental maps. But it could also be because in the malls considered for the study architectural design was not really used or not used effectively enough to create landmarks easy to perceive by users. It is important to further investigate the reasons behind this and draw implications for design.

The literature emphasizes the perceived subdivision of the environment in distinct zones as an important wayfinding aid [19], [20], [38]. In this study, respondents ranked the subdivision of the mall into clearly distinct zones second in terms of importance among the seven factors investigated, right after landmarks. Respondents of CFC and CS considered the subdivision of the mall into clearly distinct zones as a more useful wayfinding aid than respondents of MA. This could be because, with its donut layout, MA is less clearly divided into distinct zones than CFC and CS. Similarly, to landmarks, very few of the respondents considered architectural design characteristics as contributing to the subdivision of the malls into distinct zones. This perhaps suggests that there is more to be done in terms of architectural design to help mall users perceive the distinctiveness between zones. The literature suggests in particular making use of variations in form and volume of spaces, ornaments, finishes, colors, graphics, and lighting design [15], [39], [40], [53].

According to the literature, directional signs are an important feature to consider when trying to provide easy wayfinding [13]. In this study, respondents as a whole ranked directional signs third in terms of importance among the wayfinding factors investigated. However, results also indicate that the perceived importance of directional signs as a wayfinding aid increases when reported familiarity with the mall is low and decreases when reported familiarity with the mall is high. Results also show gender differences in relation to the perceived importance of directional signs. For females, directional signs ranked third after landmarks and the clear subdivision of the mall into different zones. However, for males, who tended to report lower levels of familiarity with the mall than females, directional signs were ranked as the most important of the wayfinding factors.

Furthermore, results confirm that the placement and design of directional signs affect their usage and perceived importance by mall users [9], [28], [29]. In particular, CS participants tended to indicate that directional signs in the mall were not well placed, not easy to read, and not often used. They also ranked directional signs fifth in terms of importance. In contrast, participants of the two other malls tended to rate directional signs higher in terms of placement, ease of reading, and usage and ranked directional signs as the second most important wayfinding factor.

Wayfinding literature emphasizes the circulation network as a very important component of the mental maps

that people create to help them navigate within urban and building environments [3], [4], [19], [27]. Studies have shown that certain patterns of circulation network permit, more than others, the creation of accurate mental maps and easier wayfinding (see for example Natapov et al.)[37]. In this study, respondents ranked pattern of circulation network fourth in terms of importance among the different wayfinding factors investigated. The three shopping malls selected for the study feature different patterns of circulation networks. And, in line with previous research, participants rated the linear circulation network of CFC as easier to cognize than the donut circulation network on MA. The composite layout and complex circulation network of CS were rated as the most difficult to understand.

According to the literature, visual continuity is an important wayfinding aid in shopping malls and other complex buildings [22], [25], [43], [45]. However, respondents of this study only ranked visual continuity fifth in terms of importance among the seven wayfinding factors. But, it is important to note that results suggest that mall users tend to consider visual continuity as more important when wayfinding is perceived as more difficult and as less important when wayfinding is perceived as easier. Indeed, respondents reporting a low ease of wayfinding ranked visual continuity as the second most important wayfinding factor. Furthermore, participants of CS (more complex layout) tended to rate visual continuity as much more useful as a wayfinding aid than participants of MA. CS and CFC participants were able to identify specific design features contributing to either horizontal or vertical visual continuity. They particularly emphasized wide straight corridors and atriums. For MA, with its single-floor donut circulation design, participants pointed to the outdoor space at the center of the mall.

Respondents ranked mall maps second to last in terms of importance among the seven wayfinding factors investigated. However, mall maps can be useful navigation aids, particularly in large malls characterized by a complex circulation network pattern [9]. In fact, participants of CS, the most complex of the three malls in terms of layout and circulation network, rated the usefulness of the mall maps and how frequently they are used much higher than CFC and MA participants.

While mall maps were ranked second to last among the seven wayfinding factors in terms of importance. They were still needed by CS participants, which has a more complex mall design, this could also be the result of the lower reliance on directional signs due to the lack of proper placement and design of the signs. As stated by Fewings [9] that mall maps can be useful navigation aids.

In conclusion, based on the findings of this study, a number of recommendations are formulated for the design of shopping malls to achieve better wayfinding. First, the incorporation of landmarks needs to be carefully considered. This can be achieved by adding distinct spatial features and properly placed anchor stores. Second, it is

preferable to opt for simpler layout designs. The linear circulation pattern probably provides the simplest layout design and tends to be associated with easier wayfinding. Third, different areas or zones within a shopping mall should be designed to be visually distinct. Fourth, the study strongly emphasizes the importance of visual continuity for wayfinding. Therefore, the use of wide straight corridors and of atriums is essential as they contribute to horizontal and vertical visual continuity. Finally, the design and placement of directional signs should be carefully addressed.

A number of limitations of the study need to be pointed out. First, the sampling method on which the study relied (convenience and snowball sampling) does not really guarantee the sample representativeness of mall users in general. Second, the relatively small size of some of the sub-groups within the sample may have somewhat skewed the calculated means for the sample as a whole. Results show differences in answers between males and females, between respondents reporting low and high mall familiarity, and between participants of the three different malls. However, males constituted only 32% of the sample (compared to 68% for females), low familiarity respondents constituted only 22% of the sample (compared to 78% for high familiarity respondents), and MA participants constituted only 16% of the sample (compared to 34% for CS and 50% for CFC). Finally, the use of a survey questionnaire with primarily close-ended questions as the method of data collection has its limitations in terms of fully understanding the respondents' answers.

The identification of these limitations helps outline suggestions for future research. There is certainly a need for research to confirm the findings of the present study both for the same type of mall and for other mall types. Future research could also compare findings of this study with findings of studies conducted in other countries. Finally, for a deeper understanding, future studies could attempt to combine quantitative and qualitative research methods.

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