An Analysis of Visitor Circulation: Movement Patterns and the General Value Principle

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ABSTRACT
How visitors circulate through museums determines what they will see, where they will focus their attention, and, ultimately, what they will learn and experience. Unfortunately, the consistency of these movement patterns is not readily apparent. This article reviews the literature on visitor circulation in light of the general value principle which predicts choice behavior as a ratio of perceived experience outcome (benefits) divided by perceived costs (time, effort, etc.). Although this principle at first appears obvious, its implications may be more profound.

TOWARD UNDERSTANDING VISITOR CIRCULATION

The importance of understanding how people move through museums has been recognized for many years. How visitors circulate through museums determines what visitors will see, where they focus their attention, and, ultimately, what they learn and/or experience.

Visitor movement at first appears chaotic. Some studies have found high rates of turning right at choice points, others have not. Some studies have found random-seeming movements through exhibitions, others have observed predictable walking patterns. This lack of apparent consistency in visitor circulation patterns led Falk to conclude:

A considerable body of research documents that visitors to museums rarely follow the exact sequence of exhibit elements intended by the developers. . . . Visitors will fulfill their own agendas, for example, turning right (Melton 1972; Porter 1938) or leaving from the first available exit (Melton 1972), rather than doing what the developers intended (1993, 117).

The above statement seems to imply that if visitors do not follow developers’ intended traffic pattern, the exhibit design must not have a strong influence; therefore, a visitor-centered explanation (agenda) must account for visitor behavior. Is it possible that exhibit designs inadvertently create some of the unexpected, unwanted traffic patterns? While Falk may be correct about visitors not following the intended path of the developers, his appeal to “agendas” may be an insufficient explanation for visitor circulation patterns such as turning right and leaving by the first available exit. Shettel has called Falk’s view a “visitor-centered” perspective since it emphasizes visitor-entry factors and does not include exhibit-visitor interactions (2005). An interaction approach argues that both visitor factors (such as visitor interests) and exhibit factors (design of exhibit elements, architecture, and so on) must be considered jointly. With respect to visitor circulation, the interaction perspective assumes that visitor movement patterns through museums is influenced by both what the visitor brings to the museum (prior knowledge, interests, “agenda”) and the design of the museum (exhibit elements, architecture, open space).

This article takes the exhibit/visitor interaction view; it assumes that both visitor and exhibit factors must be considered jointly. More specifically, the past experiences of the individual and his/her perceptual and cognitive characteristics interact with exhibition design to influence visitor attention, circulation and movement, mental processing, and learning. For example, we are predisposed to attend to
large, moving objects, and, if they are attractive and/or interesting, we approach them. In addition, we are more likely to attend to objects that are associated with high-interest topics than low-interest ones.

What follows is a review of the visitor circulation literature from the perspective of the general value principle. This principle suggests that visitor movement through museums can be explained in terms of the relationship between benefits (such as satisfying curiosity) and costs (such as time and effort).

THE GENERAL VALUE PRINCIPLE

The general value principle (Bitgood 2005; 2006) argues that the value of an experience is calculated (usually unconsciously) as a ratio between the benefits and the costs. We attend to things that are perceived as beneficial (such as satisfying curiosity, enjoyment) only if the costs are perceived as low in relation to the benefits. This means the value of an experience may change even if the perceived benefits stay the same. That is, if the costs (time, effort, and so on) are perceived to be high, the value of the experience is lower than it would be if the costs were perceived to be low. You are likely to choose to earn $100 if it takes only one hour and involves an activity you enjoy doing; but you are less likely to engage in the same activity if it takes 30 hours. The value of $100 is discounted if it takes too much time to earn it.

The basic assumptions of the general value principle as applied to visitor circulation can be described as follows:

• The choice of viewing or not viewing exhibit elements is strongly influenced by the benefits divided by the costs. Choice is considered to be a measure of “value.”
• Costs and benefits can be actual or perceived.
• Visitors approach objects that are perceived as attractive or interesting (perceived as beneficial). However, only a very few objects are perceived as attractive enough to merit physical approach. Many objects may be viewed because they are in the visitor’s circulation pathway and thus require little effort (no additional steps).
• Not only must the object of attention be perceived as attractive and/or interesting, but the cost (time, effort) must be perceived as low enough to warrant focused attention.
• Thus the value of the exhibit experience changes with variations in both benefits and costs.

There are some important implications that follow from the general value principle. First, decreasing costs may have a larger impact on the value of an experience than increasing benefits (Bitgood and Dukes 2006). This outcome is predicted by the mathematical relationship when benefits are divided by costs. When costs are held constant and benefits are increased, a straight-line curve results with a modest slope. However, when benefits are held constant and costs are decreased, a steeper slope, hyperbolic curve results (see figure 1).

Another implication of the principle is that there are often differences in how much control the individual has over costs and benefits. A moment’s reflection reveals that people have more control over the costs than the benefits of their choices in a museum. While they cannot change the quality of exhibits, visitors can control the costs of their behavior by reducing time and effort: by saving steps when moving through a museum, reading only short labels or small parts of long ones, and so on. The following review will reveal that patterns of visitor circulation show that visitors do reduce the cost of their movements.

Optimal foraging theory and temporal discounting are considered special cases of the general value principle since both predict choice behavior based on benefits divided by costs. Rounds has applied a foraging model to visitor behavior (2004). Similar to foraging animals, the visitor must be concerned with the costs and benefits of his/her foraging choices. Searching for information to satisfy curiosity has the cost of both time and energy expended. Rounds suggests three types of heuristics (rules of thumb) that visitors use to maximize the net interest value of time in the museum. Search rules allow the visitor to find potentially interesting items. Attention rules tell the visitor when to focus attention on the exhibits. Finally, quit rules provide guidelines for giving up on one area or gallery (or “patch,” in the parlance of foraging theory) and moving to a new area. Visitor foraging is similar to information foraging (Pirolli and Card 1999; Sandstrom 1994).

Without an empirical test of Rounds’s foraging model, it is difficult to assess. Rounds’s proposed heuristics assume active cognitive processing (rules for searching, attending, and quitting). Whether a more parsimonious cost-benefit explanation is more or less valid remains to be seen. Testing Rounds’s model
may also be difficult since it would involve studying multiple decision rules that may not operate on a conscious level, making it difficult to assess with verbal reports.

A second application of general value principle, from psychology and economics, is discounting (see Critchfield and Kollins 2001; Green and Myerson 2004). Discounting assumes that the value of a reward or incentive or positive experience is “discounted” or devalued when the time and effort required are increased. For example, a person is likely to choose $100 now rather than $200 two years from now (“temporal discounting”). If one chooses a smaller, certain prize rather than a probable, larger prize, it is called “probabilistic discounting.” Choosing a less interesting experience that involves less effort rather than a more interesting one involving more effort can be called effort discounting. In each of these examples, the value of the reward or prize or experience is decreased or discounted when the cost (time, effort) is increased.

In summary, the general value principle assumes that when the costs (time and effort) are too great, and benefits not sufficient, people choose an alternative behavior. Thus, when confronted with two exhibit objects, one perceived as more attractive and the other less attractive, visitors approach the more attractive one and ignore the other. Or, when confronted with a long exhibit label, visitors choose to ignore it or read a small portion of it.

The patterns of visitor circulation seem to make sense once the assumptions of the general value principle are applied. The following review of the literature is interpreted in terms of these assumptions. The general value principle seems to apply to other aspects of visitor behavior as well. This author has presented evidence that people decrease the cost of reading by reading short labels and/or only a small part of longer ones (2006).

CIRCULATION PATTERNS

The visitor literature reveals a number of circulation patterns that have been observed in more than one study. All of the patterns reviewed below can be thought of as “short-cutting” since they involve decreasing the cost of circulation by taking the fewest steps.

Turning right at choice points (and walking on the right side of pathways)—While some studies have reported a strong tendency to turn right at a choice point, others have not. This author reviewed literature that demonstrated the right-turn principle works only in the absence of other strong directional factors such as landmark attractors (1995). We now believe that there is a little more to the story. When right turning occurs, it involves the least amount of movement or effort.

We consider right turning as an example of “economy of movement” (or reducing the cost in terms of time and effort) because turning right, when it does occur, is motivated by taking the fewest number of steps. Consider figure 2. When people come to an intersection with the traditional four-path, perpendicular arrangement, they are generally on the right side of the path. The most economical choice is to turn right (see figure 1a). On the other hand, if one approaches the intersection on the left-hand side of the path, it would be more economical to turn left (see figure 1d). Since people tend to walk on the right, most visitors are on the right when they come to a choice point and consequently turn right. On the other hand, when people have a destination that requires a left turn, they move to the left of the path before turning—the most economical way to move. This explanation is simple and appears to account for reports in the literature.

The tendency to walk on the right side of a path has been frequently observed and is closely tied to the tendency to turn right (when it occurs). The sociologist William Whyte has studied people’s behavior in city plazas and on city streets (1980; 1988). Whyte, in his chapter on the “skilled pedestrian,” summarized the pattern of walking on the right:

Pedestrians usually walk on the right. (Deranged people and oddballs are more likely to go left, against the flow) (1988, 57).

This description of New York City pedestrians, despite his tongue-in-cheek humor, also describes people’s movement in many public places. People tend to stay to the right as they walk. But, contrary to Whyte’s implication, those who walk on the left are not necessarily deranged or oddballs—they may have a left-turn destination!
If visitors enter a gallery on the right side of the door, then turning right is the most economical response. However, if visitors enter a gallery along the left-hand wall, then continuing straight is the most economical response. The following literature appears consistent with this analysis.

Melton reported a preponderance of right-turning behavior in several galleries (1935). From 70 to 80 percent of visitors in these galleries turned right as they entered. It is important to note that the entrance door was centered so visitors had to turn right or left to view the art works on the wall, and, there were no objects in the middle of the gallery to pull the visitor toward the middle. Melton’s data does not tell us if the left turning visitors were on the left side of the path as they entered and the right turning visitors on the right of the path. Given our proposed view of the economy of movement and effort, it would be instructive to know.

Yoshioka observed a right turn bias for one exhibition hall (Hall of Man) but not for another (Hall of Medicine) at the World’s Fair in New York (1942). Each hall had multiple entrances and exits. He reported different turning percentages for each entrance of these halls, suggesting the differential influence of the exhibits. Yoshioka attributed the lack of right turning dominance in the Hall of Medicine to attraction of exhibits near the entrance (salient object attraction). An examination of the floor plan in his publication suggests that inertia (tendency to continue in a straight path) may also have been a factor, since there was an opportunity to go straight ahead as well as to the right or left. Hall of Man did not have the four-path perpendicular intersection (as shown in figure 1) present in the Hall of Medicine. In addition, exhibit displays were arranged so they attracted visitors and drew them to the right.

Weiss and Boutourline also found a right-turn bias and tendency to circulate in a counterclockwise direction depending on the design of exhibits and the design of the hall (1963). These researchers recognized that the design of the space determined whether or not right turning occurred.

Parsons and Loomis found that the right turning principle did not hold in the Pharmacy Exhibition at the National Museum of History and Technology, probably because of the attraction of “landmark” exhibits (1973). They reported that 60 percent did not turn right. The exhibition hall was considerably more complex than those studied by Melton. These researchers also found different traffic patterns when the museum was crowded (this makes sense if one considers the “cost” of fighting crowds).

Shettel, in his evaluation of Man in his Environment at the Field Museum of Natural History, provided a detailed analysis of visitor movements in this circular-shaped Exhibition (1976). He reported that 73 percent of visitors entered on the right side of the Sphere of Life.

Taylor reported predominately right-hand turns and counterclockwise flow at the Steinhart Aquarium in San Francisco (1986). Analysis of the floor plan of the Aquarium suggested that it was designed in a way that supported this traffic flow pattern. That is, fewer steps were required in order to turn right if one was walking on the right side of the path. The first intersection in the Aquarium was a T—with the choice of turning right or left (there was no option to go straight).

Deans, Martin, Neon, Nusea, and O’Reilly reported a study at the Reid Park Zoo in which visitors were asked to retrace (on paper) their circulation route through the zoo (1987). The most common circulation pattern involved turning right and circulating counterclockwise on the periphery of the zoo, essentially making a circle, but not using paths that connect one part of the outer circle with another. Of the 43 percent who followed the perimeter path, 78 percent of these visitors turned right.

Bitgood, Hines, Hamberger, and Ford did not observe a majority of visitors turning right in a changing exhibit gallery at the Anniston Museum of Natural History (1992). While the circulation patterns of the visitor changed from one exhibition to another, there was no strong tendency to turn right or to circulate in a counterclockwise direction. For two of the exhibitions (Bird Illustrations and Dinosaur), over 70 percent remained on the left-hand wall after they entered. In the Edgerton exhibition, 60 percent stayed along the left wall; for the Faces of Destiny exhibition 56 percent stayed along the left wall. In only one exhibition did less than 50 percent of visitors walk along this wall. In no case did more than 33 percent turn right.

In the above study, the architectural characteristics of the gallery and the layout of exhibit displays seemed to dictate the direction of traffic flow. The most important architectural characteristic of this gallery was the fact that visitors entered along the left wall. In addition, it is important to note that there was only one entrance/exit. Visitors left by the same door as they entered.

Underhill argued that right turning is the major pattern in retail stores. He suggested that this behavior pattern is important for retail design (1999). However, he did not offer specific, quantitative reports of his data. And he did not indicate that the pattern might be influenced by the design of the space.

Bitgood and Dukes observed people’s choice-point turning behavior at two small shopping malls (2006). The intersections studied were of the type shown in figure 1. From a single direction, six possible
Inertia (and exit gradient) — There is a tendency for people to continue walking in a straight line (generally toward a destination) unless some other factor captures their attention and pulls them away. In many ways, this is similar to the principle of inertia in physics. Melton’s “exit gradient” concept (tendency to take the straightest line between the entrance and exit) is considered a special case of this phenomenon (1935). Note that walking a straight line between two points involves the fewest number of steps. It takes a more powerful force (such as a landmark exhibit) to divert visitors from this pattern. Melton’s term “exit gradient” may not be suitable in cases where there is no exit visible, but people still walk in a straight line along a wall.

Melton’s third study in the New York Museum of Science and Industry found that the majority of people went straight ahead rather than turned right as they entered the gallery (1935). (Recall that in Melton’s other studies, there was a strong right turning bias.) It is possible that inertia was the reason, but it is also possible that attraction of a landmark object or exhibit influenced the straight-ahead movement in this case.

Weiss and Boutourline (1963) also reported a variant of the inertia principle: Visitors tend to take a fairly direct (straight line) route through a gallery, similar to the pattern Melton (1935) described.

Parsons and Loomis reported a similar “exit gradient” pattern (1973). That is, objects located along the shortest route between the entrance and exit of a gallery receive the most attention. Again, this can be interpreted as inertia—the tendency to continue in a straight line unless something more powerful pulls the visitor away from this straight line.

Bitgood, Hines, Hamberger, and Ford (as described above under right turning), found—over several successive changing exhibitions in a changing exhibit hall of the Anniston Museum of Natural History—that when visitors entered the gallery along the left wall, the vast majority tended to continue along the left wall, unless there was some salient attractor to pull them away (1992).

To summarize, inertia occurs when the design of the space makes continuing in a straight line the most economical option (saves steps) and there is an absence of a strong attractor to pull people away from this straight line. Counter to the evidence for inertia described above, some writers argue that this movement pattern does not exist (or is a minor phenomenon). For example, McLean stated that “peoples’ flow through space is generally nonlinear” (1993, 124). Perhaps—it can be argued—people’s flow through space is linear, but they can be enticed from their straight-line path by attractive objects and other salient stimuli.

Backtracking — Exhibitions that require backtracking to see all of the exhibit displays are undesirable because visitors do not want to waste time and energy (which is likely to hasten fatigue).
Taylor, in the study described above at the Steinhart Aquarium, observed that visitors expressed a desire to see the whole aquarium, but were unwilling to backtrack. Taylor noted that “...the tendency to avoid backtracking is so strong that the only visitors who did see the entire aquarium were repeat visitors who were familiar with the layout” (1986, 71).

Klein also found that visitors are reluctant to backtrack in an exhibition (1993). This is often a problem because many (if not most) exhibitions are designed to require backtracking in order to see all of the displays or objects. As Klein observed, visitors often pick one side of a two-sided exhibit hall and fail to backtrack to see the other side. The predominance of exhibit halls that require backtracking may be one of the major reasons why visitors fail to view the majority of exhibits in museums.

**One-sided viewing** — There is a tendency for visitors to move along only one side of a path through an exhibition. When exhibits or objects are displayed on both sides of a path, there is competition for visitor attention between the two sides and one or both sides will have a lower rate of attention and/or approach. To save steps, many visitors continue along one side. We might speculate that the distance from one side to another and the amount of traffic flow will strongly influence crossing the path. Thus, wider pathways and crowded conditions will discourage path crossing.

Weis and Boutourline were among the first to note that visitors rarely cross from side to side within an exhibit hall unless they detect the presence of landmark exhibits on opposite sides (1963).

Bitgood, Patterson, and Benefield compared exhibits of the same species (orangutan, cougar, leopard, camel, and otter) in several zoos (1988). Comparisons were made between each species at different zoos when exhibits were placed on one side of a walkway versus both sides. Since it takes more steps to cross back and forth from one side to the other, the general value principle might predict that visitors attend to a higher percentage of exhibits when they are placed on only one side rather than both sides. The study found fewer stops in zoo exhibit areas when displays were on both sides of a path. The difference in percent stopping averaged about 10 percent. In every case, there was a higher percentage of approach and stop for exhibits when there was no opposite-side competition. Unfortunately, this study did not document the width of the path or the conditions of crowding.

Klein found a similar tendency in an automobile museum in Germany (1993). Displays on both sides of a path seem to compete with one another for attention. Visitors tended to view exhibits on one side only.

Parsons and Loomis reported that a large percentage of visitors (41 percent) passed along only one wall of the Hall of Pharmacy (1973). Melton reported that 48.9 percent followed this pattern (1935). This tendency to stay on one wall is consistent with the notion of not crossing over to the other side of the path. Obviously, such a strategy follows the economy of movement principle.

Backtracking and competition between opposite sides of the path may be part of the same phenomenon. That is, visitors might view displays on only one side of the path either because of visual competition or because of a reluctance to backtrack (or walk from one side of the path to the other, a behavior similar to backtracking since both involve extra steps). However, there may be an important difference. When conditions are crowded or when there is a wide pathway, the oncoming traffic flow and the distance to the other side may create more avoidance than found in the typical backtracking situation. Further research is needed to clarify if these are different factors.

**Main (dominant path security)** — In several of our projects, we have observed visitors avoiding pathways that are cut off visually from the main path. There may be some type of wayfinding security staying on the main path. There is also the possibility that perceived effort outweighs the possible benefits of walking far off the main path.

Deans, Martin, Neon, Nuesa, and O’Reilly reported that the largest circulation pattern at the Reid Park Zoo was on the perimeter path that circled the zoo (1987). This path was probably perceived by visitors as the main path. By remaining on the main path, one avoids the extra walking involved in exploring other pathways.

Bitgood, Benefield, Patterson, and Litwak, in a study at the North Carolina Zoo, found that visitors were reluctant to walk down a path to an overlook of the African Plains animals that took them away from the main path (1990). If there is nothing visible to “pull” visitors down a path and if the path is perceived to require a long distance and/or time, visitors seem reluctant to move down it.

**SUMMARY AND CONCLUSIONS**
The current literature review supports the conclusion that patterns of visitor circulation are influenced by the general value principle (that is, the benefit/cost ratio predicts visitor choice of movement). However, additional empirical studies are needed to confirm the generality of this conclusion and possible limiting conditions.

Bitgood, Dukes, and Abbey (2006) have shown that the general value principle applies to reading text labels as well as to pedestrian movement patterns. In this study, respondents viewed an art print and assigned a rating of interest as to how much they would like to see text material about the art work. After assigning an interest rating, they turned the art print over to reveal a text passage. They had the choice of reading all of the text passage, some of it (as much or as little as they desired), or none of it. While interest level was found to be important in predicting reading, the length of the text passage was most important in determining reading. Short passages were more likely than long ones to be read completely no matter what the interest level. The number of words actually read did not increase as the text passage became longer; in fact, there was a tendency to read fewer words as the total number of words increased. Only a small proportion of long passages were read. Respondents definitely controlled how much they read (cost) much like visitors do in museums. Other patterns of visitor viewing (such as reading labels on the railing, but not to the side of exhibits) can also be interpreted in terms of the general value principle. If you have to exert additional effort to read the label, the cost may be too great.

If additional research confirms the power of the general value principle in predicting visitor circulation and exhibit viewing, there is an appealing parsimony to the notion that one principle can predict both of these behavior patterns (circulation and exhibit viewing).

There are a number of implications of the current analysis for designers of exhibitions.

• Develop exhibitions with these visitor circulation patterns in mind. Design so that visitors do not have to take extra steps.
• Minimize the number of steps by not requiring backtracking.
• Don’t design with multiple choice points where visitors have to make choices or where they will exit the exhibition without giving attention to all of the exhibit elements.
• Avoid designing two-sided exhibitions where exhibits on one side compete with those on the other.

Remember that the less time and effort visitors use in finding their way, the more they will value their museum experience and the more they can concentrate on the educational messages or on having satisfying experiences provided by the museum. Don’t discount the value of your exhibitions by requiring high costs.

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NOTE

1. See Bitgood 1988; Bitgood 1995; Bitgood and Cota 1995; Bitgood and Langford 1995; Gilman 1916; Loomis 1987; Melton 1935; Robinson 1928; Serrell 1998.
2. Parts of the literature review were used in Bitgood and Dukes 2006.

REFERENCES


