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## ABSTRACT

The works of Edward Robinson and Arthur Melton conducted in the 1920s and 1930s are often cited, but rarely read. The focus of this article is on one of Melton's (1935) classic visitor studies, re-examined in terms of several explanatory mechanisms including a decision-making model of visitor attention. Melton varied the number of paintings in a gallery from 6 to 36 in increments of 6. As the number of paintings increased, the proportion of paintings actually viewed decreased; however, the average viewing time per painting remained constant. Melton's findings of decreased attention are discussed in terms of four possible explanations: perceptual distraction, selective choice, object satiation, and fatigue. While fatigue, satiation, and distraction have all been frequently discussed in the visitor literature, selective choice has not. The implications of the attention-value model for selective choice is described in light of Melton's study.

**Key Words**: Visitor Attention, Attention-value Model, Visitor Choice, Perceptual Distraction

# Re-Interpreting Melton's Study of Gallery Density and Visitor Attention

Robinson (1928) and Melton (1935) reported a series of landmark studies illustrating how visitors distribute their viewing time in museum exhibitions. These studies examined a range of variables that influence visitor attention to exhibits. For example, they reported that size and location of paintings in art museums are significant factors that influence visitor attention. They also explored the concept of "museum fatigue" demonstrating that a good portion of the effect is not related to physical fatigue and is likely to involve more than one phenomenon. Additional studies examined the effects on visitors of "isolation," the degree to which an object stands alone. They argued that isolation is a powerful variable because, adding even a second object, results in "competition." Melton concluded that every object competes for attention with every other object available at the moment.

Despite the passing years, these studies are still relevant to museums today although few current museum professionals have examined the original sources. Whatever the reason for today's neglect of this body of work by Robinson and Melton, its relevance and importance for museums today should be recognized. For the most part, these studies were carefully conducted using objective, reliable, and valid methods. In addition, the studies focused on some of the most powerful variables that influence visitor behavior. The exhibit variables (e.g., isolation, size, location) studied by Robinson and Melton all relate to the class of behaviors that indicate "visitor attention." Managing visitor attention is, and always has been, a fundamental cornerstone of effective exhibition design (e.g., Bitgood, 2000; 2002; 2010; 2011; 2013; Screven, 1999). If visitors do not stop at an exhibit or do not give adequate view time, they are not likely to be meaningfully engaged and consequently are not likely to learn from the exhibit.

There is still another reason why we should examine these old studies. The findings are not frozen in the past history of theoretical explanation. The data can be interpreted (or re-interpreted) in terms of current decision-making theory. For example, current theories of behavioral economics and attention may shed new light on some of these old studies.

Behavioral economics examines behavior from an economic framework, assuming that user choice of a commodity depends upon utility and costs. Utility is a measure of satisfaction or benefit from consumption of goods, or services, or both. Costs include amount of purchase, as well as time and effort required to consume (experience) the commodity. Behavioral economics has been applied to many behaviors that are not generally considered in an economic light including impulsive behavior associated with drug abuse and overeating (e.g., Critchfield & Kollins, 2001; Whittman & Paulus, 2007) and searching the internet (e.g., Pirelli & Card, 1999). Viewing exhibits can be considered a type of consumption behavior similar to eating pizza, purchasing an appliance, or using any other type of commodity.

The attention-value model of museum visitors (Bitgood, 2010; 2011; 2013) gives the economic concept of value a prominent role in decision-making. Value is defined as a ratio of utility (e.g., benefit, reward, satisfying experience) divided by cost (time, effort, money). The concept of "value" is assumed to be the major motivational factor in engaged attention. An individual will be motivated to consume if the value is high; that is, if there is high utility relative to low costs. In a museum setting, "utility" encompasses perceived benefits, interests, curiosity, and personal preferences. "Costs" (in addition to financial) include time and effort. Visitors consider the "value" of an entrance fee: "Will I obtain sufficient satisfaction for the entrance

fee?" Visitors also consider the value of stopping to view each individual exhibit element: "Is the utility sufficient for the time and effort required to experience the exhibit?"

This is not the first time a model invoking a ratio of utility-cost (or cost-benefit) has been applied to visitors. Rounds (2004) published an article applying optimal foraging theory to visitors in which choosing to view an exhibit in order to satisfy curiosity is assumed to be determined by the benefits of satisfying curiosity and the searching/ handling time required to experience the exhibit. Bitgood and his colleagues (Bitgood, 2006; 2010; 2011; 2013; Bitgood & Dukes, 2006; Bitgood, Dukes, & Abby, 2006; Bitgood, White, & New, 2007) have proposed a value ratio of cost and benefit (utility) as a mechanism for visitor choice behavior. Value is assumed to influence both how visitors circulate through the museum in terms of time and effort (e.g., amount of walking), and visitors' choice of how much text to read.

The current paper focuses on one of Melton's studies, "The effects of variations in the number of paintings in a gallery," reported in his classic monograph (1935, pp 153-187). He systematically increased the number of paintings in a gallery from 6 to 36 in increments of 6. Three outcomes are important: (1) as the number of paintings in the gallery increased, the percentage of stops at each painting decreased; (2) total time in the gallery increased over the first two additions to the number of paintings (from 6 to 12 to 18), but remained steady for the 24-, 30-, and 36-painting conditions; and (3) across all conditions, the viewing time per painting remained constant at about 10 s per painting. Melton suggested a competition-distraction hypothesis to explain the decrease in attention (stopping) to each painting as the total number increased. He argued that every object competes with every other available object, and this competition for attention is manifested by distraction (apparently a perceptual process, although Melton did not elaborate on the mechanism). The distraction hypothesis is only one of several possible

explanations of Melton's results. An explanation from the perspective of the attention-value model is offered as an alternative.

Melton's study can be couched in terms of economic value theory in several ways. For example, we might assume that the visitor makes a choice between viewing/consuming a larger number of paintings, each for a briefer period or viewing a smaller number of paintings for a longer time per painting. Based on Melton's data, we assume that once a visitor stops, he/she will view for a constant average amount of time. As an increasing number of objects become available, visitors are assumed to be more selective, choosing the more interesting of the objects. If only higher interest objects are selected, the value (utility/cost) will increase since higher interest level increases the numerator (utility) of the value ratio, while the denominator (cost) remains low if visitors do not significantly increase the number of stops (paintings actually viewed). Thus, the value obtained from exhibit viewing is increased when visitors become more selective (choose only the higher valued objects).

The purposes of the current paper are (1) to introduce Melton's findings to current audiences who may not be familiar with these results and (2) to analyze Melton's study of increasing gallery density in terms of decision-making theory and other explanatory mechanisms.

## METHOD

### Participants

Melton observed visitors to the Pennsylvania Museum of Art in 1932 and 1933. A total of 1813 Sunday visitors and 2066 weekday visitors were observed during this study.

### Setting

The study was conducted in the American artist gallery measuring 20 ft, 10-in by 28 ft. The number of paintings varied from 6 to 12 to 18 to 24 to 30 and to 36. The first six paintings were

distributed evenly throughout the gallery and subsequent paintings were placed in spaces between or above the first six. In the six painting condition, the number of paintings per wall was 2, 2, 1, and 1. In the 12 painting condition, number per wall was 4, 3, 2, 3, etc. A different group of visitors was observed for each condition. The 6-painting condition included a sample of 635 visitors; the 12-painting condition, 723; the 18-painting condition, 436; the 24-painting condition, 631; the 30-painting condition, 861; and the 36-painting condition, 643. After the above ascending series of conditions was complete, he added a descending series (36, 30, 24, 12, and 6) to control for possible sampling error in selection of participant groups during different periods of time. The 18-painting condition was not included in this replication.

**Procedures**

This article focuses on two measures of attention: percentage of stops (mean number of stops for the original group of six paintings), and viewing time (mean viewing time for the group of six paintings/number of paintings).

**Analysis of the data**

To simplify presentation of Melton's data, the data from only the first group of six paintings are reported here. Melton also described data from the paintings added as the study progressed. Data from paintings added later showed a pattern similar to the first group (the data of which are reported here).

## RESULTS

**Average times (sec) spent in the gallery**

Table 1 includes visitors' total average time in the gallery for both weekday and Sunday visitors across all conditions of density (6 through 36 paintings. For both weekday and Sunday samples, the average viewing times increased rapidly and tended to level off on the third

condition (density of 18-paintings). The largest change was clearly within the first three conditions. One might be tempted to conclude that the optimum number of paintings is somewhere between 18 and 30. This conclusion would be misleading at best. Examining other measures showed a clearer picture of what happened when the gallery increased in density (number of paintings).

**** Include Table 1 About Here ****

**Number of stops at each group of paintings (average number of paintings viewed)**

As a dependent measure, the average total time in the gallery reported above does not consider the increase in gallery density from 6 to 36 paintings. That is, for each group of six paintings, how many were actually examined? Table 2 reports the number of stops for the original group of six paintings as the density of the gallery increased across conditions. As the gallery density increased, the number of stops at the original group of six decreased. Both weekday and Sunday visitors showed a similar decrease in stops across conditions of density. However, Sunday visitors averaged slightly fewer stops than weekday visitors.

**** Include Table 2 About Here ****

**Average percent of paintings viewed and average viewing time per painting**

Figure 1 includes percentage of stops (number of stops divided by 6 paintings) and the viewing time in seconds for the original group of six paintings across all conditions of density. The graph shows a consistent decrease in attracting value (the percent of paintings at which visitors stop) as the density (number of paintings) increased.

**** Insert Figure 1 About Here ****

Also clear from this Figure is that viewing time per painting remains at about 10 s per painting across all levels of density (6 through 36). Sunday visitors tended to show a slight decrease in viewing time for the higher density conditions. Number of paintings does not appear to influence viewing time per painting (although the Sunday visitor data may be a little ambiguous). When visitors do stop, their average stop time remains stable across all conditions of gallery density.

## Reinterpreting Melton's Results

Melton's study demonstrates that the density of a museum gallery (total number of objects) influences the mean percent of visitors who stopped at artworks; however, this decreased attention did not extend to the average viewing time per object. Melton's assumption that every object *competes* with every other object was consistent with the findings, at least for attraction (stops), but not for holding power (viewing time).

The generality of Melton's findings is supported by at least two other sources of data, a study by Porter (1938) and the database of Serrell (1998). Porter tracked visitors through the Peabody Museum of Natural History Yale University. Her data show that the percentage of exhibit cases examined in each of five galleries was directly related to the total number of exhibit cases in each gallery (although she did not explicitly report this relationship). The number of exhibit cases per gallery was a better predictor of visitor stopping than the order of the gallery. Fatigue seems less likely to explain Porter's findings since it should result in decreased viewing time over successive galleries. The two Mammal galleries contained about the same number of cases (31 and 30) and resulted in the same percentage of visitor stops (30%).

Serrell's (1998) large database of exhibition evaluations provide additional support for decreases in visitor stopping with higher density exhibitions. Because the Serrell database

studies are from many different types of museums, with data taken by different evaluators, considerable variation can be found from one study to the next. Nevertheless, the number of exhibit elements predicted attracting value (stopping) similar to Melton's study. The smallest exhibitions (under 20 elements) averaged 39.2% stopping, while the largest exhibitions (over 60 elements) averaged 26.3% stopping. These findings suggest that more is not always better.

**Explanatory Mechanisms for Decreased Attention**

Melton did not attempt to explain how his competition mechanism might work when multiple objects are available from which to choose. A detailed discussion of mechanisms or phenomena responsible for decreased attention can be found in several review papers (e.g., Bitgood, 2009a; 2009b; 2009c). Four mechanisms that might be involved in accounting for decreased attention in Melton's study include: perceptual distraction, selective choice, object satiation, and fatigue.

**Perceptual distraction**: *the presence of alternative visual stimuli (objects) pulls attention away from the target object.*

Melton's writings suggest that he favored this type of mechanism. Cognitive research on attention does support the argument that distraction occurs. However, it is not the only explanatory mechanism that is likely to be operating in the Melton study.

There is no doubt that distraction does occur in exhibition centers such as museums. A powerful stimulus associated with an orienting reflex easily distracts attention (Bitgood, 2000). In one of our first zoo studies, we found that when visitors were reading an exhibit label and a passing train blew its whistle, visitor attention was distracted from reading the label to looking at the train. In no case did we observe a return to reading after the distraction. Moving objects

(e.g., polar bear pacing in a zoo exhibit) or loud sounds are other type of salient stimuli that serve as powerful distractions. However, it seems doubtful that other paintings in an art gallery serve the same compelling distracting function as loud sounds, moving objects, or other powerful distracters.

**Object satiation***: repeated exposure to similar objects decreases attention, much like eating too much food at a meal.*

Robinson and Melton acknowledged that object satiation probably occurs, although they did not attempt to distinguish its possible cause and impact from other causes of decreased attention. A careful analysis of data should be able to separate satiation from distraction an/or selective choice since satiation is the only one of the three that takes time to develop. Distraction and selective choice occur immediately to the appropriate context.

**Fatigue:** *decreased attention resulting from effortful attention over prolonged periods of time.*

Given the small gallery size (21 X 28 feet), it is unlikely that either physical or mental fatigue processes had time to develop in the Melton study. In addition, analysis of the data suggest that fatigue could not explain the fact that stopping at the first painting (by Redfield) decreased from 61.9% to 41.1% when six additional paintings were added, even though the Redfield painting remained in the same place at the entrance to the gallery.

**Selective choice**: *when there are two or more choices available, the individual selects the one with a higher perceived value.*

Applying an economic definition of value means that the preferred choice between two alternatives has a higher ratio of utility (benefit, satisfaction, reward, interest) divided by cost

(time, effort, money). According to the selective choice explanation, as the number of paintings in the gallery increased in the Melton study, visitors were likely to become more selective and choose to pay attention primarily to artworks with higher perceived interest.

Another possible benefit of becoming more selective as the density of paintings increases is to minimize museum fatigue and object satiation. When visitors are exposed to a large number of exhibit objects to view, physical and mental fatigue are expected to develop with enough physical and mental effort over time. Whatever other benefit, becoming more selective in engaging attention to exhibit objects does save time and effort, the most treasured personal resource of the visitor. Satiation is also minimized by attending only to high-interest objects.

An implication of the attention-value model of visitors is called the "available-alternative theorem" (Bitgood, 2013, pp 69-70). Since choice is made based on the alternatives available at any moment, value is *relative* rather than *absolute*. Thus, a medium-interest object may be chosen over a low-interest object in one situation, and a high-interest object chosen over a medium-interest object in another situation. The choice of medium-interest depends upon alternatives available at the moment.

The selective-choice mechanism seems consistent with the notion of "free-choice," often used to describe museum learning. Perhaps "selective choice" is less likely than "free choice" to give the impression of a "free will" viewpoint in which scientific principles do not apply. Selective choice implies that there is a reliable and valid explanation for visitor choices.

**Further Comments on Melton's Study**

Melton's study underscores the importance of making a distinction between two measures of attention: percent stops and viewing time of exhibit objects. The number of paintings (gallery

density) had a major impact on whether or not the visitor stopped to view the painting, but little impact on viewing time once stopped. When more paintings are available to view, visitors became more selective, but the increased total number of paintings did not alter the viewing time patterns. This finding is consistent with the attention-value model (e.g., Bitgood, 2010; 2013) that argues attention capture, measured by stopping, is influenced by a different set of independent variables than attention engagement measured by viewing time, reading text, or other indicators of deeply processed attention.

In the interest of brevity, this article has omitted the painstaking efforts of Melton to consider alternative explanations and to control setting variables in a naturalistic environment. Melton identified possible confounding factors such as the size of the gallery, the architectural features of the gallery, the size of paintings in each group, object satiation and fatigue, and the use of double rows of paintings in the density conditions of 24, 30, and 36. He also addressed the double-row factor in a later study found in the 1935 monograph.

**Implications for exhibit design: Minimize Competition**

What are the implications for exhibit design? The exhibit designer is faced with the conflict of providing visitors with the largest number of objects possible, but, at the same time, ensuring that these objects maintain high value. One way to deal with this problem may be to limit the number of alternatives visually available at any moment by creating sight lines that reveal only a few objects at a time. However, an empirical demonstration of this prediction has yet to be conducted. We do know that, in general, the fewer competing objects available, the more likely each object will be given attention.

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## Footnotes

1 - Holding power is often used in two ways: view time or a ratio of actual view time divided by how long it takes to view all elements of the exhibit including reading text passages (see Shettel, 1968). To avoid confusion, we will use "viewing time" for this measure of attention.

2 - While Melton used the term "interest" to refer to visitor attention (percent stop and view time), we will distinguish between "interest" and "attention" because they seem to imply different concepts. Bitgood, White, & New (2007) found that a rating of visitor interest was not strongly related to a measure of attention (amount of a text passage read).

3 - Two theories related to temporal discounting are the matching law (e.g., Hernnstein, 1997), and optimal foraging theory (e.g., Pirelli & Card, 1999). While optimal foraging theory is generally considered "behavioral ecology," it can also be viewed as a benefit/cost ratio approach where value is a function of behavioral outcome/search and handle time.

**Table 1**
**The average time (sec) visitors spend in the Gallery under different conditions of density**

| | Density condition (number of paintings in the gallery) | | | | | |
|---|---|---|---|---|---|---|
| | 6 | 12 | 18 | 24 | 30 | 36 |
| Week day visitors | 64.9 | 89.0 | 140.4 | 140.4 | 136.0 | 156.1 |
| Sunday visitors | 60.0 | 82.6 | 104.7 | 109.7 | 122.9 | 103.0 |

**Table 2**

**The number of stops or paintings examined for the original six paintings under each condition of density (number of paintings)**

| | Density condition (number of paintings in the gallery) | | | | | |
|---|---|---|---|---|---|---|
| | 6 | 12 | 18 | 24 | 30 | 36 |
| Week day visitors | 2.96 | 2.41 | 2.53 | 2.11 | 1.94 | 1.80 |
| Sunday visitors | 2.70 | 2.20 | 2.08 | 1.83 | 1.67 | 1.61 |

**Figure 1.** Attracting power (% stops) and viewing time (mean sec per stop) for each condition of paintings (for original six paintings)