Designing Effective Exhibits: Criteria for Success, Exhibit Design Approaches, and Research Stategies

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Part 1: INTRODUCTION AND OVERVIEW

This special issue looks at three aspects of designing effective exhibits: (1) the possible criteria for assessing the success of an exhibit; (2) common exhibit design approaches or strategies; and (3) the research and evaluation strategies used to gather information on exhibit effectiveness.

Criteria for Success

Success of an exhibit can be judged in two ways – visitor measures and/or critical appraisal by experts. Visitor measures include behavior, knowledge, and affect. Critical appraisal by experts can take any of three perspectives – that of the expert in visitor studies, that of the expert in the subject-matter, and that of the artist. Each of these criteria is described in Part 2 of this article.

Exhibit Design Approaches

While designers rarely adopt only a single approach, they sometimes place heavier emphasis on one approach at the expense of others. Both the nature of the exhibition and the bias of the designers are likely to play an important role in establishing the approach which guides exhibit development. Hopefully, the implications of the various approaches are considered in the design process. If the exhibit is to be a success in the broadest sense (in terms of multiple criteria for success), it is critical that the strategies guiding development be made explicit as well as be consistent with the goals and objectives of the exhibit.

The various exhibit design approaches are not mutually exclusive. Designers usually have more than one strategy in mind when they design exhibits. For example, museums are often concerned that exhibits be designed so that they have both educational and recreational outcomes. By considering the possible impact of each design approach, exhibits have a greater chance of meeting their goals and objectives. Below is a brief definition of each approach; a more detailed discussion is found in Part 3.

Design Approaches

1. *The Subject-Matter Approach*: the major emphases are in presenting complete and accurate information with less concern for how the message will be received by the exhibit's audience or for the aesthetic appeal of the presentation.

2. *The Aesthetic Approach*: the major concern is in the aesthetic appeal of the presentation. Aesthetics take precedence over the message or the impact on audiences other than the artistic community.

3. *The Hedonistic Approach*: the major concern is that the audience will have a good time. Enjoyment (entertainment) is the primary emphasis.

4. *The Realistic Approach*: the major focus is to create a simulated, realistic experience. For example, an exhibit may attempt to produce a simulated experience of a natural habitat or a ride in a space ship.

5. *The Hands-on Approach*: exhibits are designed with the assumption that hands-on activities are inherently more effective than exhibits which require passive viewing.

6. *The Social Facilitation Approach*: when taking this strategy, exhibit designers attempt to produce exhibits that allow for or stimulate social interaction among visitor group members.

7. *The Individual-Difference Approach*: following this approach, designers attempt to develop exhibits for audiences who differ on one or more characteristics. Audiences may differ on learning preferences, learning style, cognitive ability, age, educational level, interest level, reasoning skills, etc.

While each of the above aproaches has its merits, conflict often occurs when decision-makers either overemphasize one (or several) of these approaches and/or neglect approaches that may be appropriate to the exhibit's goals. For example, curators may believe that some forms of interpretive devices, although proven to be effective, "spoil" the aesthetic appeal of an exhibit gallery.

Research and Evaluation Strategies

Both quantitative and qualitative strategies are used in visitor studies to determine the characteristics of successful exhibits and whether or not a specific exhibit is successful. Usually these strategies are combined to take advantage of the strengths of both. Quantitative analysis gives us answer to the questions of how often, how long, how many, etc. Qualitative analysis can give additional meaning to these numbers with narrative descriptions and examples.

Quantitative Strategies

The Visitor Perception Strategy: exhibit design attempts to follow principles derived from research based on the visitors' perceptions of good exhibit design and the success of exhibits is determined by how visitors react to the exhibit.

The Experimental Strategy: design principles are derived and tested through experimental research in which the effects of design variables on intended visitor behavior are carefully studied.

Qualitative Approaches

Qualitiative approaches place more emphasis on words than on numbers. Traditional statistical analysis is replaced by paraphrasing and categorizing the statements of respondents. Goals and objectives are replaced with a "let's see what our observations reveal" approach. The naturalistic evaluation approach by Wolf (1980) and the ethological methodology used by Diamond (1986) are examples of the qualitative approach, although the methodology of Diamond appears much more rigorous than that of Wolf.

Research strategies will be described in more detail in Part 4 (pp. 12-14).

Part 2: CRITERIA FOR SUCCESS

Exhibition centers use two types of criteria for determining the success of exhibits. The first type is visitor measures. As noted on the previous page, visitor measures are of three types: (1) behavioral; (2) knowledge acquisition; and (3) affective. The second type of criteria for success is judgments of experts in the form of critical appraisal.

Visitor Measures of Success

The use of multiple visitor measures is usually necessary to assess the impact of an exhibit since, in most instances, there are several goals and objectives and consequently multiple criteria for success. Each type of measurement has utility for a specific purpose; but, no one type would be valid (accurate) for all purposes. It is critical that measurements be selected so they are reliable (consistent across data collectors, time, and place) and valid (accurate with respect to the purpose for which they are chosen). If visitors' self-reports significantly distort the occurrence of their actual behavior, then such invalid verbal reports may mislead exhibit designers into making invalid inferences (e.g., visitors say they are reading labels even though they are not).

Behavior Measures

Behavioral measures involve observation and recording of overt visitor behavior. This type of measure is most valid when it is important to know exactly what people do.

It is important to realize that behavioral measures do not necessarily correlate with one another or with other types of measures. Thus, an exhibit may be highly attractive causing visitors to stop, but the exhibit may fail to hold attention long enough to deliver the critical message. Or, visitors may say they read labels when they actually gave no more than a cursory glance to the labels.

Behavioral measurement includes the following:

1. *Stopping* (attracting power). This is the fundamental measurement for determining whether an exhibit captures visitor attention. Attracting power is a report of the percentage of visitors who stop at a specific exhibit. It is obvious that if visitors do not stop, there is no chance that the exhibit will deliver its message. The most interesting exhibit label ever written might as well not exist if it is not read by visitors.

2. *Viewing time* (often expressed as holding power). After the visitor has stopped, he/she must view for a minimum amount of time in order to obtain the message. An exhibit's ability to hold visitor attention long enough to deliver the message is another basic measure of success. Viewing time is often transformed into a measure of "holding power" in which the average visitor viewing time is expressed as a fraction of the total time it would take to "get the message" (see Shettel, Butcher, Cotton, Northrop, & Slough, 1968).

3. *Social impact.* At times it may be important to assess the ability of an exhibit to facilitate social interaction among members of a group. This is particularly important for family groups with young children who need interpretive information from parents in order to understand the message (e.g., see Diamond, 1986). Social impact measures may include: asking questions, giving information to other group members, pointing, giving instructions, etc.

4. *Human factors impact.* Human factors impact is especially important for hands-on/interactive exhibits in which the visitor is expected to make an overt response. Human factors principles require that the expected response should: be obvious to the visitor; produce feedback as to whether it is correct or incorrect; and, not require an unusual amount of effort; and involve simple instructions.

5. *Trace or decay measures.* Occasionally, it is possible to measure some physical evidence of a response long after the response was made. For example, noseprints on the exhibit glass may be a valid, although rough measure of an exhibit's popularity with the visiting public.

Knowledge Acquisition

While behavioral measures can provide the most valid method of determining what visitors actually do at exhibits, they cannot usually tell us what visitors are thinking or feeling. When visitors are talking at an exhibit, we may not know whether they are talking about the exhibit or what they will eat for dinner. Therefore, another type of measure is nec-

essary to assess what visitors learn from an exhibit. Assessment of knowledge acquisition generally requires the use of language and some type of interview or written assessment. This approach is not without its problems, for example:

(a) some measures may be more sensitive than others (e.g., recognition is easier to remember than recall);
(b) the assessment may not ask for the specific information that visitors actually acquire;
(c) developing assessment devices requires an understanding of the processes of memory and learning;
(d) the knowledge measured may not be based on exhibit goals and objectives.

The two major types of knowledge acquisition are:

1. *Memory*: the ability to recall or recognize information from an exhibit. For our purposes we can categorize memory knowledge into three major classes: (a) semantic memory (general, objective knowledge about the world); (b) episodic memory (specific, subjective knowledge about an episode or experience); and (c) procedural memory (the ability to perform a mental or physical operation). See *Visitor Behavior* (1994), Volume 9, Issue No. 2 for more about memory.

2. *Comprehension*: the ability to reason from knowledge. Kinch (1994) reported a study indicating that, at least under some circumstances, text formats that improve memory do not improve comprehension or the ability to reason from the material. The implication is that simple measures of memory (recognition and recall) may fail to indicate more complex cognitive goals (making inferences from information).

Affective Measures

The third type of measure is affective. Museums are often concerned with how the attitudes and/or interests of visitors are influenced by an experience at an exhibit or within the entire museum. Still another affective measure is visitor satisfaction.

1. *Attitude change.* Expressed goals for exhibits often include attitude change (shift in beliefs or the emotional intensity of a belief). Attitude change is most likely to occur as a result of emotional appeals combined with supporting information. Attitudes related to common exhibit goals include preserving animal species or an ecosystem, the role of science in our daily lives, or feelings about modern art.

2. *Interest level.* It is often assumed that through an exhibit experience, visitors will increase their interest in the subject matter. It is not clear, however, what factors influence interest level and whether or not interest level is clearly discriminated from physical and mental states such as fatigue and satiation.

3. *Satisfaction.* Visitor satisfaction is undoubtedly an important factor in transmitting positive word-of-mouth communications of a visitor to family and friends and in considerations for repeat visitation. Satisfaction is inferred from self-reports of an experience (e.g., "The exhibit is exciting" or "I am very satisfied with the exhibit experience").

Critical Appraisal

Visitor measures are not the only way exhibits are judged to be successful. Another approach is to have knowledgeable professionals review the exhibit from an expert's perspective. This approach, if it proves to be a reliable and valid predictor of audience reaction, could save considerable resources. The "expert" perspective can take three distinct (and sometimes conflicting) forms:

1. *Visitor perspective.* A critique from the visitor perspective attempts to apply empirical knowledge from the visitor literature. Thus, an exhibit is considered better if visitors are likely to attend to it based on the literature that demonstrates labels with fewer words receive more reading than labels with a large number of words. The predictive validity of this type of critique depends upon the knowledge of the expert as well as the quality of empirical research.

2. *Aesthetic perspective.* An expert from the artistic perspective would assess an exhibit from the point of view of artistic principles such as form, color, and linear perspective. One possible problem with this perspective is the reliability of the critique. Would other artists agree on whether the exhibit follows artistic principles?

3. *Content-expert perspective.* The content expert would analyze an exhibit from the perspective of the accuracy and completeness of information. Again, experts may not agree on judgments of accuracy and completeness. One expert may dispute the accuracy of a piece of information, while other experts may not.

While all three of these perspectives serve a purpose, too often the visitor perspective is either ignored or relegated a minor role. If exhibits are designed to have an impact on visitors, then the visitor perpective must be considered.

How Should Measures Be Selected?

While there are few hard and fast rules, measures should be consistent with the goals and objectives of the exhibit. Thus, if creating social interaction is a goal of the exhibit, then social impact should be measured. If knowledge acquisition (one or both types) is a goal, knowledge acquisition should be measured. As a general rule, a combination of behavioral, knowledge acquisition, and affective measures is desirable to obtain a comprehensive view of the exhibition's impact. Figure 1 (page 16) indicates which measures are related to each specific approach. Overemphasizing one approach may result in less effective outcomes in one or more types of measure.

Part 3: APPROACHES TO EXHIBIT DESIGN

Three Basic Approaches: Subject Matter, Aesthetic, and Hedonistic

Many of the conflicts among members of an exhibition design team can be traced to differences in basic philosophy of design. Some professionals (often experts in the specific discipline) attempt to saturate the exhibit with detailed information without regard to the interests and/or cognitive processing abilities of the audience. Here, this approach is called the "subject-matter" approach. Other professionals (often with training in art and design) may be primarily concerned with adherence to traditional principles of art. Such individuals emphasize the "aesthetic" approach. Still other professionals (often advocates of let-kids-play-as-an-end-in-itself) are concerned primarily with designs that produce fun experiences with less concern for educational or aesthetic goals. This is the "hedonistic" approach. While all three approaches have merits and should be considered, overemphasizing one and neglecting the other approaches is likely to create problems in exhibit effectiveness because of failure to communicate important messages, failure to be attractive, or failure to create a satisfying experience for visitors. Examples of conflicts resulting from such problems are described below.

In one project, visitor evaluation revealed that visitors did not understand that a model of a small, little-known animal was magified 200 times. When the evaluator suggested that a brief label be placed directly on the model indicating that it was magnified 200 times, the curator of design argued that a label would ruin the aesthetic appeal of the model. This curator clearly placed aesthetic considerations above didactic. Communicating with the audience was valued less than aesthetic appeal in this example.

In another project, visitors rarely paid attention to an interpretive device placed on a stand in front of an art object. The evaluator suggested that the device be made more visually salient by placing on the device bright colors or a sign with large letters indicating that information about the exhibit object was available. The curator, however, was concerned that these changes would detract from the appeal of the art objects. Again, communicating with the audience was considered less important than aesthetic presentation.

A children's museum asked a design firm to develop children's exhibits that would be fun. When the design firm attempted to develop these exhibits with accompanying educational goals, the museum staff argued that it doesn't matter if children learn anything as long as they have fun. It was argued that children should be given the opportunity to play, rather than forced to learn something. There was no appreciation of the fact that both could occur at once.

Recommendations

Design teams may minimize these conflicts by considering the following during the development process:

1. Make clear each exhibit team member's biases at the beginning and throughout the design process.

2. Explicitly state who the intended audience(s) of the exhibition is going to be. This helps to make clear what design elements may be used to reach the audience(s). If the audience is primarily adults, then more involved label text is called for; if it is children, then more hands-on elements and less text is called for.

3. Negotiate goals and objectives. Each design team member should explicitly state the expected impact on the audience. Impact should be stated in terms of behavioral, knowledge, and affective measures. Is it acceptable if only 30% of visitors stop to view the exhibit? If only 10% read labels? If 15% can give the major point made in the exhibit?

4. Discuss whether or not the planned design will reach the audiences(s) in the most effective way in light of the goals and objectives.

Of course the ideal occurs when the subject-matter, aesthetic, and hedonistic approaches are combined in such a way that optimal performance levels on behavioral, knowledge, and affective measures are attained. Ideally, well-designed exhibits contain accurate information, communicate their messages, are attractive to look at, and produce visitor satisfaction.

Design Approaches That Employ Realism

A common design strategy (especially in zoos and natural history museums) is to create a visitor experience that simulates reality. Realistic exhibits may be justified for at least three reasons: (1) it may be assumed that realistic exhibits have greater attracting and holding power; (2) the experience of realism is assumed to have educational value in itself (visitors learn what an animal's habitat is like from a diorama); and/or (3) realistic exhibits have more affective impact.

At least four examples of the realistic approach can be found. First, is the diorama approach to exhibit design. Dioramas in natural history museums were originally designed to convey information about the habitat of animals on exhibit (Wonders, 1993).

Second is the concept of concreteness formulated by Peart (1984), Kool (1988), and Peart & Kool (1988). These investigators argued that 'concrete' exhibits (or realistic exhibits with three-dimnsional objects) are more successful than 'abstract' (or exhibits with text and no objects) in terms

of attracting and holding power, but 'abstract' exhibits are more effective in terms of teaching power.

A third example of the realistic approach is simulated immersion. Exhibits are designed so that visitors feel they are in the time and place simulated by the exhibition. Jon Coe (1985) has argued that landscape immersion exhibits in zoos provide an important educational experience to visitors.

Finally, virtual reality is still another approach to realism. Although museums are only beginning to use this technology, it will undoubtedly become a popular approach in the next few years. Virtual basketball is available now at a number of science museums and shopping malls. More sophisticated virtual reality exhibits with clear educational aims are currently being planned by a number of museums.

While realism has been a significant influence on design philosophy, only recently has there been an attempt to empirically validate the assumptions of this approach.

Dioramas

Dioramas were initially developed over one hundred years ago in natural history museums in both the United States and Sweden exclusively (e.g., Wonders, 1993). Dioramas, in their purest form, present animal species within a context of natural habitat including three dimensional, realistic-looking objects (trees, rocks, etc.) and a background painting on the back wall. Only recently has the effectiveness of dioramas been objectively studied (Davidson, Heald, & Hein, 1991; Dyer, 1992; Guisti, 1994; Harvey, Birjulin, & Loomis, 1993; Marino & Harvey, 1994; Peart, 1984; Peart & Kool, 1988; Peers, 1991;Thompson, 1993). These studies suggest that: (1) dioramas are popular with visitors and tend to generate higher visitor attention than other types of exhibits; and (2) dioramas can be combined with "hands-on" and audio-visual media to increase the exhibit's impact on visitors.

Concreteness

Peart (1984) described exhibit types on a dimension from concreteness to abstractness. According to Peart, pure concrete exhibits are three dimensional with objects; pure abstract exhibits are 'one-dimensional,' lacking objects. He studied five exhibit variations ranging from 'abstract' to 'concrete.' The most abstract exhibit consisted of labels only; next, a label with a picture; an object only; an object with label; and an object, label, and sound. The latter was considered the most concrete. It is not clear from Peart's description of concreteness why the object-only condition was less concrete than the object-plus-label condition since labels are considered abstract rather than concrete. Peart found that the exhibit considered most concrete was most effective in terms of both behavioral (attracting power and viewing time) and knowledge gain.

Kool (1985) and Peart & Kool (1988) reported an analysis of exhibits based on the Concrete Index scale. This scale was objectively defined based on: three dimensionality (objects); diorama backdrop; openness of the exhibit (as opposed to a glassed in diorama); photographs and illustrations; text material; film or slides; sound; smell; and size of the exhibit (linear measure of frontage). It is curious that, in this scale, points were given for the presence of words (which would seem to be abstract in nature). It is also difficult to understand why touch was not added to the multi-sensory elements.

Immersion

Jon Coe (1985) describes "landscape immersion" in zoo exhibits:

> "It is an approach where the landscape dominates the architecture and the zoo animals appear to dominate the public. The zoo becomes a landscape with animals. In this approach, the visitor leaves the familiar grounds of an urban park called a zoological garden, and actually enters into the simulated habitat of the animals. The animals remain separated from the public by invisible barriers, but the people do enter the animal's realm and ... may even consider themselves to be trespassers in the wilderness home of the plants and animals. Every effort is made to remove or obscure contradictory elements, such as buildings, service vehicles, or anything that would detract from the image or experience of actually being in the wilderness." (Coe, 1985, p. 9).

Yellis (1990) has described another type of immersion used at Plimoth Plantation, a living history museum:

> "What we are after is an environment, both physical and human, so authentic and of a piece, an experience of such critical mass and vitality that it becomes possible for the visitor to discount the annoying, but undeniable, reality that he is not in the past. It becomes desirable for him to relinquish the present on some level, to let go, yield himself to whatever experience he needs to have of the past, and take the initiative in precipitating that experience." (Yellis, 1990, p. 52).

Researchers have now begun to measure through self-reports the degree to which exhibit environments create an immersion experience. Bitgood (1990) reported three studies in which self-reports of immersion were correlated with other variables. For example, there was a strong relationship between ratings of "feeling of time and place" and "excitement." This suggests that feeling immersed in an exhibit experience is exciting. Such exhibits apparently have a powerful affective impact.

Thompson (1993) manipulated background context and degree to which visitors could enter the simulated environ-

ment (space surround). In this study participants were shown photographs of exhibits and asked to rate the exhibits along several dimensions. Some photographs presented a mounted animal with a white screen in the background, other photographs presented with the same animal with a naturalistic background context. This comparison attempted to assess the effects of the more realistic background context. In another comparison, one set of photographs included people touching the animals while another set showed people viewing the animals from behind a barrier. This comparison attempted to assess the impact of having the exhibit space surround the visitor. Both background context and space surround variables increased favorable ratings of the exhibit especially in terms of feelings of immersion.

Virtual Reality

Harvey, Birjulin, & Loomis (1993) have extended the notion of immersion by comparing realistic environments in museums with virtual reality environments. Virtual reality, in addition to providing a simulated environment, involves kinesthetic feedback and interaction with the environment. The authors use as an example, evaluation work on exhibits at the Denver Museum of Natural History. While the exhibits they studied are far from true virtual reality environments, there is no doubt that virtual reality will be a significant part of the museum of the future. It is easy to imagine virtual reality trips under water in a coral reef.

Summary

While approaches using dioramas, concreteness, immersion, and virtual reality all attempt to create realistic experiences, each is based on unique assumptions. The diorama approach assumes that something important is communicated by placing the object in context. The concreteness approach assumes that variables such as size, three-dimensionality, and contextual background influence attracting and holding power, but not communication. The immersion approach assumes that it is important to create a feeling of time and place. Virtual reality assumes that environmental feedback is critical.

The Hands-On Approach

> "It is a widely held and influential dictum in mainstream education that the learner should be actively involved in the act of discovery ...."
>
> (Alt & Shaw, 1984; p. 33).

In the last several years this dictum has led to the domination of "hands-on" exhibits in some informal learning institutions. Science centers and children's museums have especially emphasized the "hands-on" or participatory approach to exhibit design. Perhaps this is because children, more than adults are more attracted to such exhibits as indicated by visitor studies (e.g., Koran, Koran, & Longino, 1986; Rosenfeld & Turkel, 1982). Koran, et al. found that children were more likely than adults to interact with "hands-on" exhibits. Similarly, Rosenfeld and Terkel (1982) found that children interacted more than adults with animals and a zoo game; adults, on the other hand, spent more time than children reading labels.

There is evidence to support the argument that hands-on activities produce more success (at least in terms of attracting and holding power) than passive ones (e.g., Melton, 1972), although hands-on components by themselves don't ensure success (e.g., Borun, 1977). Borun found that simple button pushing detracted from the impact of an exhibit. To ensure success, hands-on exhibits must be carefully designed and evaluated during the development process.

An example of an unsuccessful hands-on exhibit may be instructive. An exhibit on gravity modelled after the "Falling Feather" Exploratorium Cookbook exhibit was evaluated in a science museum (Bitgood, 1991a). Eight steps had to be followed in order to understand that a feather and a piece of metal will fall at the same speed in the absence of air, but when air is present, the feather falls slower because of air resistance. Following all eight steps was complicated and took a considerable amount of time. Although about 45% of the visitors studied spent more than two minutes at the exhibit, only 25% of those who spend this amount of time were able to observe the phenomenon being demonstrated either because they did not follow instructions correctly or because the exhibit did not function properly. If this exhibit had been tested on visitors during development, it might have been altered to correct these problems.

Bitgood, Kitazawa, and Patterson (in press) found that hands-on exhibits differ in the amount of participation they generate, some stimulating more child interaction while others produce more adult hands-on behavior. Thus, the design of such exhibits may determine who participates and how much.

If hands-on exhibits are to be successful, they should follow design principles outlined in the literature (e.g., Bitgood, 1991b; Kennedy, 1990; Norman, 1988). Some of these principles are summarized below. The hands-on device should be designed so that the:

- Visual appearance makes the appropriate response obvious.
- Instructions are simple and brief.
- Feedback is provided for appropriate and inappropriate responses.
- Errors are minimized.
- Controls follow ergonomic principles.
- The exhibit's message can be communicated in a short amount of time.

While hands-on exhibits may be preferred by visitors (especially children), it does not guarantee "minds-on." Borun and Adams (1991) have shown that designing these exhibits so that they deliver the intended message is often problematic.

There is little doubt that the participatory approach to exhibit design has bred many successful exhibits. But, it is also important to note that exhibits can be successful without physical participation. For example, dioramas can be appreciated without "hands-on" elements; art objects can be enjoyed by viewing. Passive experiences can make successful exhibits.

The Social Facilitation Approach

Many have asserted that museum visitation is primarily a social event (e.g., Falk & Dierking, 1992). From this perspective, it is argued that people go to museums and zoos to be with family and friends. Consequently, exhibits should be designed to encourage such social interaction. An additional rationale for the social facilitation approach is that important learning can take place best within this social context.

The social facilitation rationale can be summarized as follows:

- Social goals are important to the vast majority of visitors and people usually visit in groups.
- Group members influence each other during their visit.
- Exhibits can be designed to facilitate social interaction.
- Social interaction is especially important when young children are part of the visting group.

Visitor researchers have collected data on visiting groups since the late 1970s. Only a few examples will be provided here. However, reviews of family group behavior in museums can be found (e.g., Falk & Dierking, 1992; McManus, 1994). In one of the earliest reported studies, Cone & Kendall (1978) observed family visitors at the Science Museum of Minnesota. They observed family interactions and attention to exhibits during the visit. Among other results, they found dioramas to be the most successful type of exhibit in terms of percentage stopping, viewing time, and recall data. Whether dioramas are more successful with families than all adult groups was not determined from this study.

Judy Diamond (1986) conducted a detailed analysis of family visits to two museums using an ethnological methodology. A sophisticated recording system documented many types of family interaction, both with each other and the exhibits. Her findings suggest that it is extremely important to study the family as a unit of analysis since family members clearly influence each other. For example, teaching behavior in the form of parents showing children what to do was commonly observed.

Diamond, Smith, and Bond (1988) in their report evaluating the California Academy of Sciences Discovery Room, argued that exhibits in a discovery room should be designed "to create a social environment as well as a physical structure." They suggested that an adult's presence influences children in two ways: it appeared to reduce the timidity of the child, and it caused the child to slow down long enough to attend to objects.

Evidence that adults behave differently with children than they do with other adults was shown in a study by Bitgood, Kitazawa, Cavender, and Nettles (1993). Dramatic differences in viewing time were found at a child-oriented exhibit – adults viewed the exhibit longer when they were with children than when they were with other adults.

The social facilitation approach is obviously important for exhibit designers to consider. It also has limitations. When a group is composed of older children, there is less need for social facilitation. Bitgood, Kitazawa, and Patterson (in press) argue that when children are young and cannot read themselves, they are dependent upon adults to provide information to "make sense" of an exhibit. Once children are old enough to extract information themselves, there is less need for high rates of social exchanges between parent and child. Another limitation of the social facilitation approach is that some topics may lend themselves poorly to social experiences. Still another limitation: group influences may be distracting. For example, when an adult is attempting to read an exhibit label, a young child's demand for attention often prevents the adult from completing the reading task.

There is no doubt that social behavior is an important part of the museum visit for the majority of visitors. But the nonsocial visitor should also be considered. In some situations, it might be appropriate to design an exhibit so that it provides different types of experienes for groups who wish to socially interact as well as for individuals who wish to experience an exhibit in a solitary manner.

The Individual-Difference Approach

The individual-difference approach emphasizes the diversity of museum audiences. This approach attempts to design an exhibit in a way that provides something for everyone. There are several forms of this approach, only a few of which will be described.

Cognitive Ability

Assuming that people learn in different ways according to their level of cognitive ability, Greenglass (1986) designed an exhibit for two different conceptual levels or information-processing abilities. In the "high-structure" exhibit the tasks to be completed and the information to be learned were

clearly stated; in the "low-structure" exhibit the visitors were given little or no guidance concerning the task. An independent measure of visitor conceptual level was used to objectively determine a measure of ability. Those who obtained high conceptual level scores learned equally well at both exhibits; whereas those with low conceptual level scores learned better with high structure exhibit than the low structure one. The implications of this study: designing for the lowest level of conceptual ability seems to produce desired outcomes for all levels.

Learning Style

Vance and Schroeder (1991) studied the effects of two types of exhibit labels on visitor learning style. The learning style of visitors was determined by the Myers-Briggs Type Indicator test. Two types of labels were designed. An "intuitive" type of label was designed for learners who were interested in reading and problem solving. "Sensing" labels were designed for learners who directly apply their five senses to the exhibit. The major findings were that learners defined as "intuitive" on the Myers-Briggs test performed better on a test of knowledge when intuitive labels were present, while visitors defined as "sensing" performed better when sensing labels were used. These results are consistent with the notion that learning styles influence visitor performance.

Interest Levels

The *Prehistoric Journey* exhibition at the Denver Museum of Natural History (Marino, 1994) is being designed to accommodate three types of audiences: "discoverers," "explorers," and "studiers." Discoverers are assumed to spend the least amount of time with exhibits; they prefer hands-on exhibits and are most likely to respond if the exhibit contains some type of high interest material. Explorers are assumed to be those visitors who experience the exhibits in a more involved manner, occasionally looking closely at things that are of interest to them. Studiers are assumed to be highly motivated learners who spend the time necessary to absorb complex information. They read labels, study diagrams and discuss the exhibit with other group members. Even if data does not support the notion that visitors can be easily divided into these categories, designing for this range of audience interest may be a useful way to provide exhibit material for a wide range of interest levels and for varying interest levels within the duration of a visit.

Demographic Characteristics

Numerous studies have found differences between males and females, between adults and children, and between more educated and less educated visitors. The characteristic of age is often used as a basis for designing exhibits (e.g., children's museums). While exhibit design does not often consider gender differences, such considerations might prove useful to ensure that both male-female interests and points of view are represented.

Summary and Critique

The individual-difference approach in its various forms has been criticized for the following reasons:

1. There has been no systematic replication of the studies by Greenglass and Vance & Schroeder.
2. Critiques argue that the dimensions selected represent continuums rather than discrete categories (e.g., Serrell, 1993).
3. There is often a problem in defining individual differences.
4. There is a danger of stereotyping visitors.

This approach also has its strengths:

1. It recognizes the existence of diverse audiences. This should encourage designing exhibits for the broadest range of audiences.
2. The individual difference approach gives credence to the possibility that interests, preferences, and/or cognitive abilities or styles may influence the impact of exhibits.

In summary, the individual-difference approach may have merits, but the validity of the individual variations of this approach (e.g., learning style) has yet to be convincingly demonstrated.

Have you renewed your membership to the Visitor Studies Association?

This is your last issue of

Visitor Behavior

if you do not renew

See page 2 for the address of the Visitor Studies Association

Part 4: RESEARCH AND EVALUATION STRATEGIES

Quantitative Strategies

Quantitative approaches have been the traditional research and evaluation strategies used in museums. These strategies rely on numbers and statistical data reduction methods. They base their approach on the basic assumptions of science. Below are two major types that are subsumed under the quantitative strategy.

The Visitor Perception Strategy

The visitor perception strategy of research and evaluation starts with the visitor. Visitors are asked for their judgements concerning how exhibits are best described and what makes a successful exhibit. A variation of this strategy is to ask visitors to rate exhibits along some dimension and the results are used to formulate design guidelines. This strategy has the advantage of using descriptors in visitors own words rather than those which are created by the researcher and may not express the thoughts and feelings of visitors.

Alt & Shaw (1984) used this strategy to determine the characteristics of the "ideal museum exhibit" at the Natural History Museum (London). (A more detailed summary of this study can be found on page 16). Characteristics were derived by asking visitors to identify descriptors that apply to exhibits and then with a second group of visitors applying these characteristics to specific exhibits. They found that the following items strongly apply to the "ideal" exhibit:

- It makes the subject come to life.
- You can understand the points it is making quickly.
- There's something in it for all ages.
- It's a memorable exhibit.
- It's above the average standard of exhibit in this exhibition.

Other items were strongly negative with respect to the ideal exhibit:

- It's badly placed – you wouldn't notice it easily.
- It doesn't give enough information.
- Your attention is distracted from it by other displays.
- It's confusing.

While this research strategy may be fruitful, the Alt and Shaw results have an important limitation. Most of these descriptors are expressed more as visitor outcomes and do not provide guidance on how to design exhibits. If visitors describe a particular exhibit as "memorable," or "It makes the subject come to life," designers are still left with the problem of determining what characteristics make it memorable or make the subject come to life.

Another example of the visitor perception research strategy is provided by Finlay, James, and Maple (1988). They reported a study in which a group of individuals generated adjective pairs while viewing slides of animals in a variety of settings. Another group rated the adjective pairs for their appropriateness in describing animals. Only the pairs rated as highly appropriate were selected for the study. Selected pairs included: harmful-harmless, friendly-unfriendly, graceful-clumsy, free-restricted, tame-wild, etc. Four groups were tested: (1) a control group rated the eight animals on name alone; (2) a naturalistic zoo group (shown slides of animals in naturalistic zoo surroundings); (3) a zoo group (animals in cages); and (4) a wild animal group (slides of animals in the wild). Perception of animals were very different depending on the context in which they were observed. Zoo animals were perceived as restricted, tame, and passive; wild animals were seen as free, wild, and active.

The Finlay et al (1988) study provides us with one important relationship between design and impact – the background context of an animal is related to visitors' perception of that animal. Thus, this study is more directly useful to the designer than that of Alt and Shaw (1984).

Another form of the visitor perception strategy correlates survey items that describe design variables (e.g., "The lighting level helps to create a desirable atmosphere" and "It uses senses other than visual") with visitor impact items ("The exhibit is memorable" or "It makes the subject come to life"). Using many of the items from Alt and Shaw, Bitgood (1990) asked visitors to rate exhibition areas on a number of descriptors. Design factors were then correlated with impact factors. Some interesting relationships were found. For example, "It uses senses other than visual" was correlated ($r=.521$) with "It makes you want to learn more about the subject matter." It would be an important outcome of this approach if it can be shown that adding multisensory components to an exhibit increases motivation to learn.

The Experimental Strategy

The experimental strategy starts with a logical analysis or empirical review of the design variables (e.g., size, location, movement, etc.) that are likely to influence visitor outcomes. Hypotheses concerning important design variables are formulated and then systematically tested through experimental studies in which design variables are manipulated and the effects on visitor outcomes are measured. Once effective design variables are identified, they are incorporated into the exhibit design process. If experimental research determines that short labels are more likely to be read by visitors, then exhibits are designed with short labels. This approach has adopted the research strategies traditionally used in social science and education.

Shettel, Butcher, Cotton, Northrop, and Slough (1968) have provided a model for this approach. They began by identifying three sets of variables involved in the effectiveness of exhibitions: (1) exhibit design variables; (2) exhibit effectiveness variables; and (3) exhibit viewer variables. Exhibit design variables (considered to be independent variables or variables that are manipulated in a study) include: amount of verbal material; readability level of material; legibility of material; use of audio-visual communication; total amount of time required to view exhibit materials; location and sequence of displays; and use of constant and dynamic models. Exhibit effectiveness variables (dependent variables or outcome variables) include: ability to attract attention; holding power; change in interest; change in attitudes; and knowledge acquisition. Exhibit viewer variables (variables that are generally held constant in research studies) include: age; education; knowledge of subject; viewing time; intelligence; initial level of interest; etc. According to the approach of Shettel and his colleagues, research progresses by manipulating or systematically changing exhibit design variables and determining the impact on exhibit effectiveness variables (visitor behavior), while holding viewer variables constant.

The use of this approach in museums dates back over 60 years. Melton (1935) in one of several visitor studies in which he controlled exhibit variables, hypothesized that the density of exhibit objects influences visitor attention. To test this hypothesis, he systematically altered the number of paintings in a gallery. His results were consistent with the notion that each object competes with every other object in a gallery. As the number of objects increased, the average attention for each object tended to decrease. The design implication is that exhibit objects will receive more attention when they are isolated from other objects.

The experimental approach is not without its critics (e.g., Munley, 1990; St. John, 1990). Some critics have argued that the experimental method cannot be used to study complex relationships in museums (e.g., St. John, 1990). However, there are many studies that demonstrate experimental methods can be useful in understanding the role of multiple factors in exhibit settings. For example, Bitgood & Patterson (1993) studied the effects of several exhibit changes on visitor behavior. Independent variables included length of label (50 versus 150 words), number of labels (one, three, and six), size of text font, location of labels, presence of illustrations, and the presence of an additonal exhibit object (a bronze bust) in the gallery. Dependent variables included visitor stopping, duration of viewing time, and label reading at all exhibit elements (Egyptian mummy cases, display of x-rays of mummified individuals, labels on walls, and a recreated bronze bust of one of the mummified individuals). Each time the conditions were changed in the gallery, visitors redistributed their overall pattern of attention to exhibit elements. For example, when the length of labels was reduced, more visitors read the labels and viewing time of the mummy cases increased. Another result that demonstrated how the experimental approach can detect complex processes relates to the difference between readers' and nonreaders' attention to exhibit objects. The addition of a bronze bust in the gallery increased nonreading visitors' viewing time of x-rays of the mummified individuals; however, reader's viewing time at the x-rays remained unchanged at a high level.

The experimental strategy is not without its disadvantages. They include:

(1) it is not always easy to control variables in the real world;
(2) it may be difficult to convince museums to allow the necessary exhibit design changes to determine cause-effect relationships;
(3) it requires knowledge and skills in research methodology;
(4) if not carefully designed, the experimental situation may lack experiential realism (the visitor may not interpret the experience as real).

It should be noted that studies carried out in exhibition settings are rarely able to design a "true" experiment since participants are seldom randomly selected from the population of all visitors. Under such circumstances, the research is generally called "quasi-experimental" rather than "experimental." However, if careful sampling procedures are used to select participants, the study approximates a "true" experiment.

The Correlational Strategy

Another research strategy is to correlate design variables with visitor measures. For example, Bitgood, Conroy, Pierce, Patterson, and Boyd (1989) examined the correlation between visitor label reading and the number of words per label. A correlation of .71 was found between these two variables suggesting that visitors more more likely to read shorter labels. Correlational methods have become more sophisticated including factor analysis and cluster analysis, techniques that allow the invesitagor to identify complex patterns of correlation. The correlation strategy does not allow as strong conclusions about the effects of design variables. A correlation tells us there is a relationship between two variables, but does not tell us if the design variable is actually causing the effect.

Summary of Quantitative Strategies

The visitor perception strategy begins with formulating exhibit characteristics in visitors' own words. It assumes that visitor descriptors can provide predictive information regarding what makes an exhibit successful. Also, in this approach, design variables are selected by visitors' descriptions of exhibits.

The experimental strategy argues that, whenever possible, exhibit design should be based on carefully controlled research in which design variables are manipulated and their effects on visitor behavior measured. Three major characteristics of this strategy are: (1) there are no *a priori* assumptions about what design approaches are more effective (the design variables identified as important by a particular approach must be empirically tested); (2) design variables are generally identified by the researcher rather than by the visitor; and (3) the impact of design variables is empirically determined.

The correlation strategy examines how variables correlate with one another. A simple correlation between two variables (visitor reading and number of words) may be examined. Or, more complicated techniques might identify clusters or factors of variables. See Alt and Shaw (1984) for an example of cluster analysis and Harvey et al. (1993) for an example of factor analysis.

Qualitative Strategies

As noted on page 4, qualitative strategies can help to give meaning to the quantiative data. Qualitative analysis deals with words rather than numbers. Data reduction methods summarize, paraphrase, and categorize respondents statements rather than statistically analyze.

It is difficult to characterize qualitative strategies because advocates of qualitative methodologies differ from each other in their basic assumptions. At one end of the spectrum are investigators who accept the basic assumptions of science. They look for ways to combine quantitative and qualitative approaches so that these two strategies complement one another.

At the other end of the spectrum are investigators who reject the basic assumptions of quantitative strategies arguing against any attempt to formulate general laws of visitor behavior. "Instead there is a focus on the use of metaphor, analogy, informal inference, vividness of description, reasons-explanations, interactiveness, meanings, multiple perspectives, tacit knowledge." (p. 240, M. Scriven,1991).

Naturalistic Evaluation

Scriven (1991) described Bob Wolf's definition of naturalistic evaluation as stressing:

- orientation toward 'current and spontaneous activities, behaviors, and expressions rather than to some statement of prestated formal objectives;'
- responding to 'educators, administrators, learners, and the public's interest in different kinds of information;' and
- accounting 'for the different values and perspectives that exist.'

Wolf's approach stressed unstructured interviews, observation, and 'meanings rather than mere behaviors.' Scriven suggests that some of the advocates of this approach "may have gone too far in the laissez-faire direction (any interpretation the audience makes is allowable) and in caricaturing what they think of as the empiricist approach." (Screvin, 1991, p. 240).

FINAL THOUGHTS

This article has attempted to identify three aspects of designing sucessiveness exhibits. The first is selecting the criteria for success. A multi-measure approach to visitor data collection is suggesting including behavior, knowledge, and affective measures. If critical appraisal is used as a criteria (visitor, subject-matter, or aesthetic), the perspective should be made clear and should have some basis for validation. Thus critical appraisal from the visitor perspective should be based on empirical visitor studies.

The second part of this article describes design approaches that appear to dominate the museum world. An attempt was made to point out some of the strengths and weaknesses of each approach.

The last part of this article describes research and evaluation strategies used to obtain data related to the success of exhibits. Both quantitative and qualitative strategies are commonly used in museums, and each can contribute to a better understanding of what makes exhibits successful.

A better understanding of the three issues discussed in this article can lead to more thoughtful design of exhibits, more careful consideration of approaches, and more reliable andvalid measures of success.

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