Analysis of Differences Between Visitors at Natural History Museums and Science Centers

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Introduction

The most basic form of museum audience research is the visitor survey. And while many museums periodically conduct a visitor survey to learn about demographic characteristics, psychographics, perceptions, and attitudes of their visitors, lack of standardization in instrument design makes it difficult to generalize about visitors at particular museum types and to compare characteristics of visitors at one museum type to visitors at another (Loomis, 1987: 67). To date, the only comprehensive examination of visitors to a particular museum type is the study, *The Audience for American Art Museums* (Schuster, 1991), conducted by the National Endowment for the Arts.

As individual museums become increasingly concerned about broadening their audiences they are trying to attract new visitors by offering varied programs. Art museums curate shows that include historical interpretations of their collections (*The West as America* at the National Museum of American Art) and history museums produce science-oriented exhibitions (*Science in American Life* at the National Museum of American History). This sharing of disciplines among museum types raises interesting questions about the expectations and preferences of history museums visitors, for example, who venture to their local art museum to see archeological excavations from the *Royal Tombs of Sipán*, a current traveling exhibition. This issue is further complicated by museum staffs' lack of knowledge and inability to articulate details about their actual audience, potential audience, and target audiences (Miles, 1986).

The findings presented here are from a front-end evaluation for a traveling exhibition about severe weather. This project was being developed through a collaboration among the Smithsonian Institution Traveling Exhibition Service, National Museum of Natural History, St. Louis Science Center, and National Severe Storms Laboratory, National Oceanic and Atmosphere Administration.

The purpose of conducting this front-end evaluation was twofold. First, like many front-end evaluations, the exhibition planning team wanted to have a solid understanding of visitors' perceptions and their baseline

knowledge regarding a particular subject — in this case, severe storms (Screven, 1990: 38-41). Second, the institutions that expressed interest in hosting the exhibition were both science centers and natural history museums. Team members, composed of individuals representing both institutional types, wondered whether potential visitors to the exhibition would differ depending on whether the hosting institution was a science center or natural history museum. They asked such questions as: In what ways do natural history museum audiences differ from science center audiences? Do visitors to the respective institutions expect or prefer different types of exhibitry? Does the environment of a science center, for example, draw a certain type of visitor? This article presents findings from the part of the evaluation that focused on differences between visitors to natural history museums and science centers. The goals of this portion of the study were to determine:

- differences between natural history museum visitors and science center visitors regarding demographic and group composition data (gender, age, education level, permanent residence, and group size and type)
- differences between natural history museum visitors and science center visitors regarding ratings of interpretive strategies (computer-based programs versus informational text, for example).

Method

A relatively short standardized questionnaire had visitors respond to basic demographic questions (gender, age, education level, permanent residence, size of visiting group, and type of visiting group) and a question about the kinds of interpretive strategies they like in a museum or science center. This question listed nine strategies (as shown in Table 6) and asked respondents to rate each one on a seven-point scale ranging from "Don't like at all" to "Like very much."

Evaluators recruited eligible respondents (over 14 years of age) at high traffic areas in each museum, using a continuous random sampling method. The standardized questionnaire was completed by 743 respondents. Data were collected at two science centers and two natural history museums as follows:

National Museum of Natural History, Washington, DC
St. Louis Science Center, St. Louis, Missouri
Miami Museum of Science, Miami, Florida
California Academy of Sciences, San Francisco, California

All data were collected during a four-week period in the summer of 1994. From mid-July through mid-August, every Thursday, Friday, and

Saturday, data were collected at one of the participating sites. Each week data were collected at a new site.

When visitors declined to participate in the study, evaluators recorded their gender and approximate age. The refusal rate was 15 percent. To determine if there were gender and age differences between the refusal and respondent sample, a chi-square analysis (for gender) and t-test (for age) were calculated. There was no difference regarding gender, but the t-test showed a significant differences in the mean ages of the two samples. The mean age of respondents was 37.88, while the mean age of refusals was 41.03. Those who declined to participate in the study were significantly older than respondents ($p<.001$). This finding suggests that the standardized questionnaire findings may not accurately reflect the demographics and opinions of older visitors.

Data Analysis

Percents were calculated for all categorical variables, and summary statistics, including the mean, median, and standard deviation were calculated for interval and ratio variables (see note 1). For all statistical tests (chi-square, t-test, and ANOVA), the significance level was set at $p \leq .05$.

Data from the two natural history museums were combined into one data set, and data from the two science centers in another. The two data sets were then analyzed so comparisons between natural history museum respondents and science center respondents could be made and discussed.

Findings

A total of 743 questionnaires were collected at the four participating institutions. The natural history museum sample totaled 395 completed questionnaires, and the science center sample totaled 348 completed questionnaires.

Demographics

Slightly more women than men were attracted to natural history museums and science centers (53 percent and 47 percent, respectively). As shown in Table 1, there was little difference between natural history museums and science centers regarding gender composition. Science centers attracted slightly older visitors than did natural history museums (mean years=39.10 years and 37.39 years, respectively; not shown in table), but the differences is not statistically significant.

Respondents who were accompanied by children were also asked to record the age in years of each child. Natural history museums attracted slightly older children than did science centers (mean age=9.31 years and 8.95 years, respectively; not shown in table). This difference, however, is

not statistically significant. Generally, more than half of the children who visited these types of institutions were 6-12 years of age.

Adult respondents were asked to indicate their highest level of formal education from a list of seven options. To determine if these differences were statistically significant, the seven options were collapsed into three. A chi-square analysis (see Table 2) shows that natural history museum visitors have more formal education than science center visitors ($p<.001$).

More natural history museum visitors than science center visitors have "some college/bachelor's degree" (54 percent and 49 percent, respectively) and "some graduate work/graduate degree" (34 percent and 30 percent, respectively).

Size and Type of Visiting Group

Science centers attracted larger visiting groups than did natural history museums, as shown in Table 3. Natural history museums attracted more individuals and visitor pairs than did science centers (42 percent and 22 percent, respectively), and science centers attracted more groups composed of three or more visitors than did natural history museums (78 percent and 58 percent, respectively). This difference is significant ($p<.001$).

Respondents were also asked to indicate from a list of five options the one that described their group type. For both institutional types, there were more groups composed of adults and children than any other group type, but science centers attracted more adult/children groups than did natural history museums (74 percent and 53 percent, respectively). Also, as noted above and shown again in Table 4, natural history museums attracted more adult pairs than did science museums (26 percent and 13 percent, respectively). These differences are statistically significant ($p<.001$).

Respondents were asked to record the number of children in their group, and, as expected, science centers attracted visitors with more children per visiting group than did natural history museums (see Table 5). In fact, nearly half of natural history museum respondents did not come with any children (46 percent), compared to one-quarter of science center respondents (25 percent). Thirty-three percent of natural history museum respondents and 58 percent of science center respondents were with two or more children. These differences are statistically significant ($p<.001$).

Respondents were asked to rate nine interpretive strategies on a seven-point scale ranging from "Don't like at all" (1) to "Like very much" (7). Means and t-tests were calculated to determine if mean scores from the natural history museum sample differed significantly from those from the science center sample. Table 6, which ranks the interpretive strategies in descending order based on the total means, summarizes some of these findings.

The three highest-ranked strategies for natural history museums and science centers were "live demonstrations," "things to handle/touch/

manipulate," and "objects or artifacts." For five of the nine strategies, natural history respondents' mean ratings were significantly different from science center respondents' mean ratings. As shown in Table 6, "video programs," though ranked seventh by both respondent samples, was rated higher by science center respondents than by natural history museum respondents (5.01 and 4.58, respectively; $p<.001$). "Computer games," too, was rated significantly higher by science center respondents than by natural history museum respondents (5.07 and 4.24, respectively; $p<.001$). The same trend holds true for "activities for small groups"; science center respondents rated it significantly higher than natural history museum respondents (4.85 and 4.25, respectively; $p<.001$).

Respondents' ratings of "live demonstrations" and "things to handle/touch/manipulate" were very high on the seven-point scale. Nearly half or more than half of the respondents from each sample rated them a seven (natural history museums: 45 and 44 percent, respectively; science centers: 53 percent and 52 percent, respectively; see note 2). Thus, ratings for these two strategies were placed into two categories: those who rated the strategy a seven, and those who rated the strategy below seven. As shown in Table 7, significantly more science center respondents rated "live demonstrations" higher than did natural history museum respondents (53 percent and 45 percent, respectively; $p<.001$). Additionally, significantly more science center respondents rated "things to handle/touch/manipulate" higher than did natural history museum respondents (52 percent and 44 percent, respectively; $p<.001$).

Ratings of interpretive strategies data were examined with age and visitor group type data to determine if there were any significant relationships. There were several significant relationships with both variables.

Ratings of six of the nine interpretive strategies were significant with age. As shown in Table 8, older respondents rated "objects or artifacts" higher than did younger respondents ($p=.002$). The same holds true for "video programs," "dioramas," and "activities for small groups" ($p=.005$; $p=000$; and $p=.024$, respectively). Although the mean ratings for "objects or artifacts," "video programs," and "activities for small groups" by respondents 45-54 years of age do not follow the upward trend, the t-tests indicate the upward trend is significant.

As one might expect, younger respondents rated "computer games" significantly higher than did older respondents ($p=.007$).

A test for linear trend of proportions across categories of age was conducted for the ratings of "things to handle/touch/manipulate." By comparing the high-rating percentages to the low-rating percentages in each age group, one can see that for ages 14-34, more respondents rated the strategy high than rated it low. For the remaining three age categories (respondents 35+), more respondents rated the strategy low than rated it high ($p=.008$) (see Table 9).

ANOVA showed that two of the interpretive strategies were significant with group type. Adults visiting alone and adults visiting with children rated "video programs" and "computer games" higher than adult pairs (p+.000 for both). This finding is summarized in Table 10.

Discussion

The focus of much of the analysis was to determine differences between natural history museum visitors and science center visitors, although similarities between these visitor groups emerged as well. There is little difference regarding gender and age among visitors to each institutional type. Slightly more women than men were attracted to both natural history museums and science centers, and while science centers attracted a somewhat older audience, the difference is not statistically significant. The mean age of child visitors to science centers was slightly younger than the mean age of child visitors to natural history museums, but again, the difference is not statistically significant.

The ratings and rankings of the nine interpretive strategies provide interesting and useful information for exhibit developers, and some striking similarities between visitors to each institution are accentuated. For adults, the three highest-ranking strategies for both institutional types were "live demonstrations," "things to touch/handle/manipulate," and "objects or artifacts." It is interesting to note that "live demonstrations," which are probably the least common communication vehicle used in any museum type, ranked the highest. Their popularity may be due to adults' wanting access to a knowledgeable person to whom they could ask questions. "Explainers," as they are sometimes called, provide a non-threatening and easy way for visitors to satisfy their curiosity. In some regards, explainers make the visitor experience smooth and easy. Visitors do not have to wade through text to find answers to their questions. "Things to touch/handle/manipulate" also ranks high. It is widely known that children enjoy hands-on experiences. That is how children learn best — by doing. Data from this study suggest that adults, regardless of whether they frequent natural history museums or science centers, like it too. Too often museum practitioners talk about children and parents as two unique audiences. In some respects they are, but perhaps in a very important respect — museum learning — they are very much the same. This is something for all exhibition developers to consider as they design exhibitions for intergenerational groups.

These three exhibition opportunities, in many ways, cover a broad range of possible exhibition mediums, excluding computerized or electronic components. "Objects and artifacts," the most traditional exhibition approach, ranks third. This suggests that visitors' desire to see museum objects is still relatively strong.

Science centers attracted larger visitor groups than did natural history museums, and they also attracted groups with more children. The types of groups at science centers differed from those at natural history museums in that science centers attracted more adults and children than did natural history museums, but natural history museums attracted more adults, either alone or with other adults, than did science centers.

Significant differences also emerged. Type of visiting group was an important variable with two of the interpretive strategies. Adult pairs rated "video programs" and "computer games" significantly lower than did adults visiting alone and adult-children groups. Since the natural history museum sample had twice as many adult pairs as did the science center sample, and the exhibition in progress will travel to natural history museums as well as to science centers, the number of "video programs" and "computer games" in the exhibition will have to be carefully balanced to accommodate the high proportion of adult pairs in natural history and the high proportion of adult-children groups in science centers. The content placed in the "video programs" and "computer games" must also be placed in other interpretive strategies because adult pairs in natural history museums may not use the "video programs" or "computer games."

Adult respondents at science centers rated "video programs," "computer games," and "activities for small groups" higher than did adult respondents at natural history museums. In fact, overall, adult respondents at science centers rated six of the nine items higher than did adult respondents at natural history museums. The three strategies rated higher by natural history museum respondents were "objects or artifacts," "informational text/panels," and "dioramas." These ratings suggest that visitors' expectations, which are probably tied to previous experiences in natural history museums or science centers, may be a factor.

Visitors who frequent one type of institution may learn to expect a certain type of interpretive strategy, and visitors may also visit one institutional type because it tends to have interpretive strategies they have learned to expect. For example, science centers typically have more computerized exhibitions than do natural history museums, therefore, science center visitors may respond more favorably to computer games and come to expect them. Natural history museums tend to have dioramas, artifacts, and text-heavy interpretive exhibitions, whereas these three interpretive strategies are often absent from science center exhibitions. Thus, it is not surprising that natural history museum adult respondents rated "dioramas" "informational text/panels," and "objects or artifacts" higher than did science center adult respondents.

Age is an important factor regarding the ratings of some interpretive strategies. Older respondents rated "objects" or artifacts," "video programs," "dioramas," and "activities for small groups" significantly higher than did younger respondents, and younger respondents rated "computer games" significantly higher that did older respondents. In addition, for the ages 14-

34, more respondents rated "things to touch/handle/manipulate" high than rated it low, and for the ages 35+, more respondents rated it low than rated it high. Since visitors to each institutional type are similar regarding gender and age — the ratio is 53:47, and mean age is 38.19 — this finding is important when thinking about an overall plan for a traveling exhibition, regardless of institutional type.

Visitors to any exhibition rarely visit all exhibit components (Serrell, 1992; Korn, 1993; Korn and Ades, 1995). They pick and choose where they will spend their time, and their choices are often a reflection of their personal interests regarding content and interpretive strategy (which are, in part, dependent on age) and the visual and physical quality and appeal of the exhibit component (Munley, 1983; Falk, 1993). The age variations cited above can be utilized from that perspective. Exhibit planners should consider that older visitors (generally) may stop at cases with artifacts more frequently than will younger visitors (generally) and, younger visitors may use computerized components more frequently than will older visitors. These findings suggest that messages within the exhibition, and especially the big messages, must be evenly distributed throughout the exhibition components. Older visitors who may not use any of the computerized exhibits, should have access to the same type of information as younger visitors, who may use the computerized exhibits. Messages must be presented in several different ways, using a variety of modalities.

Any exhibition that will travel to both natural history museums and science centers presents a challenge to exhibit developers largely because natural history museums attract more adult visitors without children. Adult visitors have specific preferences regarding interpretive media, and this difference, though evident in data from both institutional types, seems more prominent for natural history museums simply because they attract more adults-without-children groups than do science centers.

The museum community would benefit from knowing more about audiences across museum types. Do zoos attract a different audience from botanical gardens? In what ways are they similar or different? How are visitors to history museums different from visitors to children's museum? Consider visitors to art museums. Would they, too, enjoy seeing live demonstrations or having hands-on experiences? While this study did not address whether or not natural history museum visitors are also science center visitors, one could assume that many museum visitors visit more than one museum type, Knowing more about visitors, generally and specifically, would provide museums practitioners with practical information relevant to exhibition and programming planning and enable them to provide learning experiences that are more responsive to their visitors' interests and preferences.

Notes

1. To answer specific questions about the relationship between natural history museum visitors and science center visitors, cross-tabulation tables were computed to show the joint frequency distribution of the two samples. Chi-square (x^2) analysis was used to test the significance of the relationship of the two samples. T-tests and analysis of variance (ANOVA) were used to compare the mean scores of the rating scales of natural history museum samples and science center samples.

2. It is not appropriate to run a t-test with scores that are not normally distributed, so to determine if there was a difference in the way the two respondent samples rated the two strategies, the data were made dichotomous and a chi-square was calculated.

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Table 1.
Demographic Characteristics

Characteristic	Natural History %	Science %	Total %
Gender (Adult respondents)			
Female	54	53	53
Male	46	47	47
Age (Of children accompanying adult respondents)			
Under 5	18	18	18
6-12	55	63	59
13-20	27	20	23
Age (Adult respondents)			
14-24	17	10	13
25-34	25	27	26
35-44	33	36	34
45-54	17	16	17
55+	09	12	10
Education (Adult respondents)			
Grade school	00	02	01
Some high school	01	02	02
High school diploma	11	17	14
Some college/associate degree	28	25	27
College graduate/bachelor's degree	26	24	25
Some graduate work	09	08	09
Graduate degree	24	22	23

Table 2.
Education Level (Collapsed) of Respondents in Percent
N=740

Education Level	Natural History	Science	Total
High school or less	12	21	16
Some college/ bachelor's degree	54	49	52
Some graduate work/ graduate degree	34	30	32

$x^2 = 10.738$; df=2; p=.005

Table 3.
Number of Visitors in Visitor Groups in Percent
N=739

Number of Visitors	Natural History	Science	Total
1-2	42	22	33
3-4	35	47	41
5+	23	31	27

$x^2 = 31.004$; df=2; p=.000

Table 4.
Group Type in Percent
N=743

Group Type	Natural History	Science	Total
Adults and children	53	74	63
Adult pairs	26	13	20
Several adults	11	08	10
Adults alone	08	03	06
Tour group	02	02	02

$x^2=38.812$; df=4; p=.000

Table 5.
Number of Children per Visitor Group in Percent
N=737

Number of Children	Natural History	Science	Total
None	46	25	36
One	21	18	19
Two	19	33	26
Three or more	14	25	19

$x^2=46.581$; df=3; p=.000

Table 6.
Ratings and Rankings of Kinds of Interpretive Strategies

Exhibit Type	Natural History (sd)	Science (sd)	Total (sd)
Live demonstrations	5.64 (1.6)	5.98 (1.4)	5.80 (1.5)
Things to handle/ touch/manipulate	5.54 (1.8)	5.95 (1.4)	5.73 (1.6)
Objects or artifacts	5.53 (1.5)	5.34 (1.4)	5.44 (1.5)
Dioramas	5.21 (1.6)	5.10 (1.5)	5.16 (1.6)
Things to listen to	5.07 (1.7)	5.23 (1.5)	5.15 (1.6)
Informational text/panels	5.17 (1.7)	4.92 (1.7)	5.05 (1.7)
Video programs[1]	4.58 (1.7)	5.01 (1.6)	4.78 (1.7)
Computer games[2]	4.24 (2.1)	5.07 (1.8)	4.63 (2.0)
Activities for small groups[3]	4.25 (2.0)	4.85 (1.8)	4.53 (1.9)

1. $t=-3.41$; $df=723.71$; $p=.001$ 2. $t=-5.87$; $df=712.60$; $p=.000$ 3. $t=-4.22$; $df=701.98$; $p=.000$

Table 7.
Ratings of "Live Demonstrations" and "Things to Handle/Touch/Manipulate" in Percent N=724 (Demonstrations); N=721 (Manipulate)

Strategy	Natural History 1-6 (low) / 7 (high)	Science 1-6 (low) / 7 (high)
Live Demonstrations[1]	55 / 45	47 / 53
Things to Touch/Handle/Manipulate[2]	56 / 44	44 / 52

[1] $x^2=-4.213$; $df=1$; $p=.040$ [2] $x^2=-4.591$; $df=1$; $p=.032$

Table 8.
Age by Ratings of Interpretive Strategies

Exhibit Types	14-24	25-34	35-44	45-54	55+
Objects or artifacts[1]	5.18	5.29	5.55	5.46	5.84
Video programs[2]	4.21	4.83	4.92	4.73	5.04
Dioramas[3]	4.83	5.05	5.11	5.22	5.91
Activities for small groups[4]	4.17	4.68	4.49	4.29	5.10
Computer games[5]	4.70	4.88	4.80	4.03	4.22

1. $t=3.173$; $df=716$; $p=.002$; 2. $t=2.785$; $df=714$; $p=.005$; 3. $t=4.433$; $df=695$; $p=.000$;
4. $t=2.265$; $df=694$; $p=.024$ 5. $t=-2.710$; $df=707$; $p=.007$

Table 9.
Age by Ratings of "Things to Handle/Touch/Manipulate" in Percent

Rating	14-24	25-34	35-44	45-54	55+
1-6 rating (low)	12.9	21.4	36.2	18.5	11.0
7 rating (high)	14.3	30.9	32.9	13.7	8.2

Test for linear trend=4.876; $df=1$; $p=.008$

Table 10.
Group Type by Ratings of "Video Programs" and "Computer Games"

Exhibit Type	Adults Alone	Adult Pairs	Adults and Children
Video programs[1]	5.07	4.39	4.94
Computer games[2]	5.21	4.21	4.78

1. $F=8.6461$; $p=.000$ 2. $F=8.1629$; $p=.000$