

RK&A

Exhibition Evaluation

Summative Evaluation of *Wild Music*

Prepared for
**Science Museum of Minnesota
Saint Paul, MN**

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EXECUTIVE SUMMARY

This report presents the findings from a summative evaluation of the NSF-funded *Wild Music* traveling exhibition conducted by Randi Korn & Associates, Inc. (RK&A), for the Science Museum of Minnesota in Saint Paul, Minnesota. The evaluation documents the exhibition's impact and effectiveness using timing and tracking observations and onsite exit interviews. Data were collected at the North Carolina Museum of Natural Sciences (NCMNS) in July and August 2007 and at the Peggy Notebaert Nature Museum (PNNM) in March and April 2008.

**Selected highlights of the study are included in this summary.
Please consult the body of the report for a detailed account of the findings.**

PRINCIPAL FINDINGS: TIMING AND TRACKING OBSERVATIONS

The evaluators observed a total of 173 drop-in visitors 9 years of age and older (74 at NCMNS and 99 at PNNM).

VISITOR DESCRIPTIONS

- ◆ 55 percent of visitors were females and 45 percent were males.
- ◆ 85 percent of visitors were adults (18 years and older).
- ◆ 81 percent of visitors were attending the exhibition in a multigenerational group.
- ◆ Visitors observed at NCMNS were demographically similar to those observed at PNNM.

OVERALL VISITATION PATTERNS

- ◆ Not including unique exhibits at each venue, visitors' total time in the exhibitions ranged from 47 seconds to more than two hours, with a median time of about 19 minutes.
- ◆ Not including unique exhibits at each venue, visitors stopped at between 1 and 25 exhibits, with a median of 8 exhibits.
- ◆ NCMNS visitors spent more time and stopped at more exhibits in *Wild Music* than did PNNM visitors.
- ◆ NCMNS visitors moved more slowly through *Wild Music* than visitors to other exhibitions of similar size and discipline.
- ◆ NCMNS visitors used *Wild Music* to the same degree of thoroughness as visitors to other exhibitions of similar size and discipline.

VISITATION TO INDIVIDUAL EXHIBITS

- ◆ At both venues, visitors spent the most time in the Jamming Room (median = 5 minutes, 19 seconds), followed by the Music and Memory Station (median = 3 minutes).
- ◆ At NCMNS, visitors spent the most time in the Investigate Lab (median = 9 minutes, 34 seconds).
- ◆ At both venues, visitors spent the least time at Miniature Musicians (median = 19 seconds).
- ◆ NCMNS visitors spent more time at seven exhibits (including the Jamming Room) than did PNNM visitors.

- ◆ At both venues, the Jamming Room attracted the most visitors, followed by the Xylophone, and The Power of Music Theater (69 percent, 54 percent, and 54 percent, respectively).
- ◆ At NCMNS, the Investigate Lab attracted the most visitors (69 percent).
- ◆ At both venues, the Talking Drum, How Are Animal Sounds like Music?, and Discovery Cart attracted the fewest visitors (12 percent, 7 percent, and 0 percent, respectively).
- ◆ NCMNS visitors were more likely to stop at 21 exhibits (including the Jamming Room) than were PNNM visitors. Conversely, PNNM visitors were more likely to stop at one exhibit (What is Music, Anyway? listening station) than were NCMNS visitors.

VISITOR BEHAVIORS

- ◆ 86 percent listened to audio. Of the visitors who used audio, 93 percent used headphones at one or more exhibits.
- ◆ 77 percent did activities.
- ◆ 72 percent discussed exhibit content.
- ◆ 36 percent listened to audio description.
- ◆ 1 percent listened to Spanish audio.
- ◆ NCMNS visitors were more likely to listen to audio and do activities than were PNNM visitors.

PRINCIPAL FINDINGS: ONSITE EXIT INTERVIEWS

RK&A conducted onsite interviews with a total of 76 visitor groups (30 at NCMNS and 46 at PNNM) comprised of drop-in visitors age 9 years and older as they exited *Wild Music*.

REACTIONS TO THE EXHIBITION

Most interviewees expressed positive opinions about *Wild Music*, specifically its interactive nature, compelling content, and appealing design. High points for visitors included the Jamming Room, the diversity of animal and natural sounds featured in the exhibits, and having the opportunity to hear and feel sound vibrations. While responses to the exhibition were overwhelmingly positive, some interviewees described the overall density of exhibit experiences as overpowering and several reacted negatively to exhibits that required the use of headphones.

When asked whether they visited the Jamming Room, many interviewees indicated that they had not visited this exhibit and offered a range of reasons for bypassing it, including lack of time, overcrowding and noise level, and their discomfort sharing an enclosed space with strangers. Those interviewees who used the Jamming Room described its main message as either demonstrating the diversity of music and the connection between music and nature, or simply giving visitors the opportunity to collaborate in making music.

REACTIONS TO THE SOUND ENVIRONMENT

Interviewees acknowledged hearing a number of nature sounds in the exhibition, such as whale songs and birdcalls, and musical instruments, such as drums, didgeridoo, and xylophone. All interviewees were able to find sounds that appealed to them and to which they felt connected. Some found the nature sounds most compelling and personally relevant; others cited the musical instruments as being meaningful and stimulating memories.

Most interviewees reported no difficulties listening to sounds in the exhibition or problems with sound bleed between exhibits. However, several expressed negative opinions about headphones, for thwarting social interaction and sanitary concerns.

When asked whether they noticed the ambient sounds playing throughout the exhibition, about two-thirds of interviewees acknowledged hearing the soundscape. Of those, many said they had listened attentively to the ambient sounds and described what they heard as general nature sounds or a type of habitat (e.g., rainforest). Some noted the soundscape but did not pay much attention to it. Conversely, one-third of interviewees did not hear the ambient sounds.

UNDERSTANDING OF EXHIBITION CONTENT

All interviewees mentioned music or sound as they described the exhibition's main message. Many said the exhibition was about attentive listening, while others said it demonstrated that music is everywhere, presented different aspects of animal communication, or showed the ancient origins of music.

In terms of ideas, feelings, or messages they gleaned from the exhibition, many interviewees reiterated that the exhibition reminded them to listen more attentively to the sounds around them, while some said it enhanced their appreciation of the complexity of sound. A few said the exhibition broadened their definition of music.

When asked how music connects humans to other living things, many interviewees said humans and other animals make sounds that can be interpreted as music. Similarly, many added that humans and other animals make musical sounds to communicate. In contrast, a few were unsure of a connection.

The interviewer asked interviewees what they learned about how people are studying music and sound. Nearly two-thirds of interviewees were unsure and indicated that they either did not see or did not pay attention to information in the exhibition about musicology or acoustics. Of the one-third of interviewees who gleaned information about the study of music, most discussed non-human communication, for example the study of birdcalls, while several mentioned the work of ethnomusicologists.

DISCUSSION

VISITOR OBJECTIVES

Wild Music provided compelling experiences for a range of museum visitors, including adults and children. Both the observations and interviews demonstrated that visitors were actively engaged with the exhibition. Observed visitors spent considerable time in the exhibition and used it thoroughly, as compared with exhibitions of similar size and content (Serrell, 1998) and compared to other SMM traveling exhibitions (RK&A, 2002; 2004; 2007; 2008). In fact, *Wild Music* visitors spent twice as long in this exhibition than Serrell's average visitor. While SMM staff wondered about the density of exhibits in *Wild Music*, visitors found the exhibition comfortable and engaging. Most observed visitors listened to audio, used interactives, and discussed exhibit content with their companions. These findings are corroborated by the interviews, as interviewees praised the hands-on quality of the exhibits and the range of experiences offered.

Wild Music was also successful in terms of visitor learning. The majority of interviewees readily connected with the exhibition content, found the content and experiences meaningful, and grasped key messages. For example, many interviewees said the exhibition honed their listening skills and increased their awareness and appreciation of the range of musical sounds. Many also grasped how music connects humans with other animals and the ancient origins of music. While the exhibition was overwhelmingly successful in achieving the stated learning objectives, there were two learning objectives that the majority of visitors missed: visitors will use specific terminology to describe musical sounds; and visitors will be able to describe interdisciplinary sciences involved in the study of biomusic. These objectives may not have fared well because the three most attended exhibits—the Jamming Room, Xylophone, and The Power of Sound and Music Theater—did not directly address these learning objectives. Additionally, the exhibition introduction panel was poorly positioned at both venues (at NCMNS it was on the wall opposite the ticket counter, outside of the exhibition space, and at PNNM it was on a wall far from the other *Wild Music* exhibits). Another contributing factor may be that the Discovery Cart was somewhat underutilized (at NCMNS the Cart was set up outside the exhibition space simply to draw visitors' attention to the exhibition, while at PNNM the Cart was rarely available because of staffing challenges). While it is difficult to control all aspects of an exhibition as it travels to different venues, SMM should consider emphasizing to host sites the importance of using the Discovery Cart to convey science concepts and of positioning the introduction panel so that it can provide a framework for visitors' learning.

INSTITUTIONAL OBJECTIVES

Wild Music provided some unique challenges and opportunities. One objective of SMM staff was to provide visitors with high quality audio experiences. Interviewees were able to clearly hear the intended audio and did not experience any problems with sound bleed between exhibits or unintended noise levels. For example, the soundproof room used for the Jamming Room worked perfectly, retaining all the noises within it, regardless of how many visitors were using the room. The use of headphones also worked for the majority of visitors. Nearly all of the observed visitors used headphones, and for most interviewees the headphones did not pose a concern.

Another objective of SMM staff was to create a highly accessible exhibition for visitors with disabilities, in general, and visitors who are blind or have low vision, in particular (i.e., to a much greater extent than the ADA requirements). During the formative evaluation, RK&A conducted focus groups comprised of visitors with disabilities to provide feedback about the exhibit's accessibility and SMM staff made changes based on that study (RK&A, 2006). SMM staff also provided all text and most audio in

Spanish. This necessitated brief text in both English and Spanish which may have had the side-benefit of encouraging visitors to actually read and discuss the text. In fact, a higher percentage of *Wild Music* visitors discussed exhibit content than visitors to other SMM traveling exhibitions (RK&A, 2002; 2004; 2007). Additionally, English-only speaking visitors did not find the Spanish text distracting and, in fact, praised the exhibition for having it. SMM's efforts to create an exhibition that would be as accessible as possible are commendable; its strategic effort and final product should serve as a model for other museums that wish to do broaden their audiences through innovative exhibition development. However, RK&A was not able to evaluate the effectiveness of either one of these efforts in the summative evaluation because too few visitors with disabilities and Spanish-speakers attended the exhibition. While lack of visitor diversity is an issue for the museum field at-large, it is unfair to expect a single exhibition to bring in new audiences. Museums have been trying to create audience diversity for many years, but additional concerted efforts are needed—not just from exhibition teams, but from the whole organization, as achieving audience diversity is everyone's responsibility.

There are initiatives to help museums address diversity challenges. For example, a number of years ago NSF provided the Association of Science-Technology Centers with a grant to train and support museum practitioners at many institutions in serving visitors with disabilities. More recently, in the cultural sector, the Wallace Foundation has been providing arts organizations, including museums, with grants to increase participation among underserved audiences. The goal of these Excellence Award grants is to support audience development through program development, marketing, and evaluation. While *Wild Music* is a highly accessible traveling exhibition, it is one exhibition in an ocean of available traveling exhibitions, and it is one project in a museum with many projects. *Wild Music* is an interesting case study for audience development in science museums and could serve as a model for other science museums to follow. Additionally, though, it can also serve as inspiration for all museum departments—not just an exhibition department—to create museum-wide initiatives to diversify audiences.

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INTRODUCTION

This report presents the findings from a summative evaluation of the *Wild Music* traveling exhibition conducted by Randi Korn & Associates, Inc. (RK&A), for the Science Museum of Minnesota in Saint Paul, Minnesota. *Wild Music* was funded by the National Science Foundation.

Data were collected at the North Carolina Museum of Natural Sciences (NCMNS) in July and August 2007 and at the Peggy Notebaert Nature Museum (PNNM) in March and April 2008. The evaluation documents the exhibition's impact and effectiveness by examining visitors':

- ◆ Response to the exhibition,
- ◆ Use of the exhibits (percentage of visitors who stop, time spent at each exhibit),
- ◆ Experiences in the Jamming Room,
- ◆ Awareness of the intentional environmental sound track and its impact on their experience,
- ◆ Perception of unintentional ambient noise and its impact on their experience,
- ◆ Use of listening skills,
- ◆ Meaning constructed from their experiences,
- ◆ Affective and cognitive experiences (including whether the learning outcomes were met, see Appendix A), and
- ◆ Differences in experiences by Spanish-speaking audiences and by venue.

METHODOLOGY

RK&A used two data collection strategies to assess visitors' experiences in the exhibition: timing and tracking observations and onsite exit interviews.

TIMING AND TRACKING OBSERVATIONS

Visitor observations provide an objective and quantitative account of how visitors behave and react to exhibition components. Observational data indicate how much time visitors spend within the exhibition and suggest the range of visitor behaviors.

All visitors 9 years old and older were eligible to be unobtrusively observed in the exhibition. The data collector selected visitors to observe using a continuous random sampling method. In accordance with this method, the observer stationed him/herself at entrance to the exhibition, and observed the first eligible visitor to cross the threshold, following the selected visitor through the exhibition, recording the exhibits used, noting select behaviors, and logging total time spent at each exhibit and in the exhibition as a whole (see Appendix B for the observation forms). When the visitor completed his/her visit, the observer returned to the entrance to await the next eligible visitor to enter the exhibition.

INTERVIEWS

Open-ended interviews produce data rich in information because interviewees are encouraged and motivated to describe their experiences, express their opinions and feelings, and share with the

interviewer the meaning they constructed during a visit. The interview guides were intentionally open-ended to allow interviewees to discuss what they felt was meaningful. All interviews were audio-recorded with participants' permission and transcribed to facilitate analysis.

Upon exiting the exhibition, visitors 9 years and older were eligible to be selected for participation following a continuous random sampling method, as described above. Eligible visitors were invited to answer several questions about their exhibition experiences immediately following their visit (see Appendix C for the interview guide).

DATA ANALYSIS

QUANTITATIVE ANALYSIS

The observation data were analyzed using SPSS 12.0.1, a statistical package for personal computers. Analyses include descriptive and inferential statistics. Within the body of the report, only statistically significant relationships are presented; however, all statistical analyses that were run with the observation data are listed in Appendix D.¹

Frequency distributions were calculated for all categorical variables (such as “age,” or whether or not a visitor was “used audio”). To examine the relationship between two categorical variables (for instance, “visiting with a child” and “doing an activity”), cross-tabulation tables were computed to show the joint frequency distribution of the variables, and the chi-square statistic (X^2) was used to test the significance of the relationship.

Summary statistics, including the mean (average), median (data point at which half the responses fall above and half fall below), and standard deviation (spread of scores: “±” in tables), were calculated for ratio-level variables (such as, “total time spent in the exhibition”).² To test differences in the medians of two or more groups, a Mann-Whitney U test was performed (for instance, to examine whether the “total time in the exhibition” differed by “age” or “gender”).

QUALITATIVE ANALYSIS

The interview data are qualitative, meaning that results are descriptive, following from the interviews' conversational nature. In analyzing the data, the evaluator studied responses for meaningful patterns, and, as patterns emerged, grouped similar responses. To illustrate interviewees' ideas as fully as possible, verbatim quotations (edited for clarity) are included.

¹ The level of significance was set at 0.01 because of the moderate sample size. When the level of significance is set to $p = 0.01$, any relationship that exists at a probability (p -value) of ≤ 0.01 is termed “significant.” When a relationship has a p -value of 0.01, there is a 99 percent probability that the relationship being explored truly exists; that is, in 99 out of 100 cases, there would be a relationship between the two variables (e.g., age and exhibits stopped at). Conversely, there is a 1 percent probability that the relationship does not really exist; in other words, in 1 out of 100 cases, a relationship would appear by chance.

² For the most part, medians rather than means are reported in this document because, as is typical, the number of components used and the time spent by visitors were distributed unevenly across the range. For example, whereas most visitors spent a relatively brief time with exhibition components, a few spent an unusually long time. When the distribution of scores is extremely asymmetrical (i.e., “lopsided”), the mean is strongly affected by the extreme scores and, consequently, falls further away from the distribution's central area. In such cases, the median is the preferred measurement because it is not sensitive to the values of scores above and below it—only to the number of such scores.

REPORTING METHOD

The data in this report are quantitative and qualitative. For the quantitative data, information is displayed in tables and graphs. Percentages within tables may not always equal 100 owing to rounding. The findings within each topic are presented in descending order, starting with the most frequently occurring.

The interview data are presented in narrative. The interviewer's remarks appear in parentheses, and, for visitors, an asterisk (*) signifies the start of a different speaker's comments. At the end of each quotation, where an interviewee was interviewed, followed by the interviewee's gender and age, is indicated in brackets. Trends and themes in the data are presented from most- to least-frequently occurring.

**FINDINGS IN THIS REPORT ARE
PRESENTED IN TWO MAIN SECTIONS:**

1. Timing and Tracking Observations
2. Onsite Exit Interviews

PRINCIPAL FINDINGS: TIMING & TRACKING OBSERVATIONS

Observation data for the *Wild Music* traveling exhibition were collected at the North Carolina Museum of Natural Sciences (NCMNS) in July and August 2007 and at the Peggy Notebaert Nature Museum (PNNM) in March and April 2008. Data collectors observed a total of 173 drop-in visitors 9 years old and older (74 at NCMNS and 99 at PNNM). Data for the total sample ($n = 173$) is in this report unless the difference between venues was statistically significant.

DATA COLLECTION CONDITIONS

Readers should note that museum admission to NCMNS was free but visitors paid a fee for visiting *Wild Music*; whereas, visitors at PNNM paid a general admission fee that included *Wild Music*.

Three-quarters of the observations took place on weekend days (76 percent) and one-quarter on weekdays (24 percent) (see Table 1). About three-quarters of the observations were collected in the afternoon (71 percent) and one-quarter in the morning (29 percent). Nearly two-thirds of visitors experienced a low level of crowding (62 percent). Few visitors experienced broken exhibits (2 percent).

TABLE 1

DATA COLLECTION CONDITIONS

CONDITIONS	TOTAL %
DAY OF THE WEEK (n = 173)	
Weekend day	76.3
Weekday	23.7
TIME OF DAY (n = 173)	
PM	71.1
AM	28.9
LEVEL OF CROWDING (n = 170)	
Low	61.8
Moderate	35.3
High	2.9
BROKEN/NOT AVAILABLE EXHIBITS (n = 173)	
No broken exhibits	97.7
1 or 2 broken exhibits*	2.3

*Observers noted that the following exhibits were broken during the data collection period (the number of times observers noted this is included in parenthesis following each exhibit): What is Music, Anyway? listening station (1 time) and Electronic Voice interactive (3 times).

VISITOR DESCRIPTIONS

Data collectors recorded the gender and approximate age of each observed visitor. As shown in Table 2, the sample included slightly more females than males (55 percent and 45 percent, respectively). The sample was predominantly adults (18 years and older) (85 percent). Most adults ranged in age from 25 to 44 (61 percent).

TABLE 2

VISITOR DEMOGRAPHICS

CHARACTERISTIC	%
GENDER (n = 173)	
Female	54.7
Male	45.3
APPROXIMATE AGE GROUP (n = 172)	
9 to 11 years	8.7
12 to 14	4.7
15 to 17	1.7
18 to 24	6.4
25 to 34	30.8
35 to 44	30.2
45 to 54	8.7
55 to 64	7.0
65 years and older	1.7

Nearly all observed visitors attended the exhibition in a multigenerational group (i.e., in groups of adults and children) (81 percent) (see Table 3).

TABLE 3

GROUP COMPOSITION

DESCRIPTION (n = 173)	TOTAL %
Adults and children	80.9
Adults only	16.2
Alone	2.9

OVERALL VISITATION PATTERNS

This section presents the total time spent and stops made in *Wild Music*. At NCMNS, the temporary exhibition space included the Investigate Lab (a staffed area that provides hands-on activities related to traveling exhibitions) which was an additional element not featured at the other *Wild Music* venue. There were other differences in the exhibition setup at the two venues: at NCMNS the introduction panel and Discovery Cart were outside the temporary exhibition space and, as such, were not included in the observations at this site; at PNNM the introduction panel and Discovery Cart were included within the exhibition.

Because of the differences in exhibition setup at the two venues, the total times are presented for the entire sample, with and without the unique exhibits, as well as by venue.

TOTAL TIME SPENT IN THE EXHIBITION

WILD MUSIC TOTAL TIME DATA

Visitors' total time in *Wild Music*, including the Investigate Lab, ranged from 47 seconds to more than two hours, with a median time of approximately 21 minutes (see Table 4). When the time spent at exhibits unique to each venue is not included in the total time calculation, the median time is 19 minutes.

TABLE 4

TOTAL TIME SPENT IN THE EXHIBITION: TOTAL SAMPLE

TOTAL TIME (<i>n</i> = 173)	INCLUDING UNIQUE EXHIBITS %	NOT INCLUDING UNIQUE EXHIBITS %
Less than 15 minutes	39.3	41.0
15 min. – 30 min.	23.1	28.4
30 min. – 45 min.	15.1	13.8
Longer than 45 min.	22.5	16.8
SUMMARY STATISTICS (<i>n</i> = 173)	INCLUDING UNIQUE EXHIBITS HOUR:MIN:SEC	NOT INCLUDING UNIQUE EXHIBITS HOUR:MIN:SEC
Range	0:47 to 2:20:30	0:47 to 2:15:52
Median time	21:14	19:18
Mean time	27:48	24:44
(±) Standard deviation	± 24:19	± 21:20

Statistical analyses of the median time visitors spent in the exhibition revealed that NCMNS visitors spent three times as long in the exhibition (median = 36 minutes) compared with PNNM visitors (median = 10 minutes) (see Table 4a). Readers should note that at NCMNS, visitors purchased a timed ticket to visit *Wild Music*; whereas, at PNNM the exhibition was included in the general admission price.

TABLE 4a

DIFFERENCES IN TOTAL TIME SPENT IN EXHIBITION BY VENUE

SITE	<i>n</i>	NOT INCLUDING UNIQUE EXHIBITS MEDIAN TIME MIN:SEC
NCMNS	74	36:33
PNNM	99	10:32

Mann-Whitney U = 603.5; *p* = 0.000

SWEEP RATE INDEX

To compare the total time spent in *Wild Music* with other exhibitions of similar size, RK&A used Serrell’s “Sweep Rate Index” (SRI) (Serrell, 1998).¹ The SRI is one measure to compare exhibitions at various museums. It is calculated by dividing the exhibition’s square footage² by the average total time spent in the exhibition.³ The lower the SRI, the more time visitors spent per square foot of space.

The SRI for *Wild Music* at NCMNS, not including the Investigate Lab, is 166 square feet per minute. This SRI is lower than Serrell’s average SRI for both large nondiorama exhibitions (>3,900 sq. ft.) and science-related exhibitions.⁴ This means visitors in *Wild Music* are moving more slowly than visitors in exhibitions of similar size and type. The SRI of *Wild Music* is within the range of other SMM traveling exhibitions RK&A has evaluated: *Disease Detectives* (SRI=146), *Race Are We So Different?* (SRI=169), *Invention at Play* (SRI=217), and *Playing with Time* (SRI=282).

TOTAL NUMBER OF EXHIBITS AT WHICH VISITORS STOPPED

WILD MUSIC TOTAL STOPS DATA

Wild Music included between 32 and 33 exhibits at which visitors could stop.⁵ For this evaluation, a “stop” was defined as a visitor standing for three seconds or longer in front of a component. If a visitor returned to a component at which s/he had previously stopped, this return was not counted as an additional stop, but the amount of time spent was included in the total time spent at the component.

Not including the exhibits unique to each venue, visitors stopped at between one and 25 exhibits, with a median of eight exhibits (see Table 5).

TABLE 5

TOTAL NUMBER OF EXHIBITS STOPPED AT IN THE EXHIBITION: TOTAL SAMPLE

NUMBER OF EXHIBITS (n = 173)	INCLUDING UNIQUE EXHIBITS %	NOT INCLUDING UNIQUE EXHIBITS %
Fewer than 6 exhibits	29.5	30.6
6 to 8	21.9	24.3
9 to 11	17.4	14.5
12 or more	31.2	30.6

SUMMARY STATISTICS (n = 173)	INCLUDING UNIQUE EXHIBITS	NOT INCLUDING UNIQUE EXHIBITS
Range	1 to 26 exhibits	1 to 25 exhibits
Median number	8 exhibits	8 exhibits
Mean number	9 exhibits	9 exhibits
(±) Standard deviation	6 exhibits	6 exhibits

¹ Serrell, B. (1998). *Paying Attention: Visitors and Museum Exhibitions*. Washington, D.C., American Association of Museums.

² The temporary exhibition space at NCMNS is 6,800 sq. feet, not including the Investigate Lab. The PNNM did not provide the square footage of the temporary exhibition space.

³ Mean total times were used in the SRI calculation in accordance with Serrell’s methods. Throughout the rest of the report, median times are reported, as the median is standard for time data unevenly distributed across its range.

⁴ Serrell reports an average SRI of 400.5 (±191.5) for large nondiorama exhibitions and 300.0 (±156.7) for science-related exhibitions.

⁵ At NCMNS, the exhibition included the Investigate Lab but did not the introduction panel or the Discovery Cart (which were placed outside the temporary exhibition space). Conversely, at PNNM the exhibition included the introduction panel and Discovery Cart but did not the Investigate Lab.

Statistical analyses of the median number of stops visitors made in the exhibition revealed that NCMNS visitors stopped at twice as many exhibits in the exhibition (median = 12 exhibits) compared with PNNM visitors (median = 6 exhibits) (see Table 5a).

TABLE 5a
DIFFERENCES IN NUMBER OF EXHIBITS STOPPED AT IN THE EXHIBITION
BY VENUE

SITE	n	NOT INCLUDING UNIQUE EXHIBITS MEDIAN NUMBER
NCMNS	74	12 exhibits
PNNM	99	6 exhibits

Mann-Whitney U = 1305.0; $p = 0.000$

PERCENTAGE DILIGENT VISITOR INDEX

To compare the number of stops visitors made in *Wild Music* with those of exhibitions of similar size and venue, RK&A used Serrell’s “Percentage Diligent Visitor Index” (%DV).¹ The %DV is obtained by calculating the percentage of visitors who stopped at more than one-half of the exhibits. The higher the %DV, the more thoroughly the exhibition was used.

The %DV for *Wild Music* at NCMNS is 26 percent—that is, 26 percent of visitors stopped at more than one-half of the exhibits (i.e., 16 exhibits or more). This %DV is similar to Serrell’s average %DV for both large nondiorama exhibitions (>3,900 square feet) and science-related exhibitions,² indicating visitors used *Wild Music* to the same degree of thoroughness as visitors to other exhibitions of similar size and type. The %DV of *Wild Music* is higher than the %DV of any other SMM traveling exhibition that RK&A has evaluated: *Disease Detectives* (%DV=7), *Race Are We So Different?* (%DV=3), *Invention at Play* (%DV=0), and *Playing with Time* (%DV=0).

¹ Serrell, B. (1998). *Paying Attention: Visitors and Museum Exhibitions*. Washington, DC, American Association of Museums.

² Serrell reports an average %DV of 23.4 percent (± 20.4) for large nondiorama exhibitions and 25.8 percent (± 22.4) for science-related exhibitions.

VISITATION TO INDIVIDUAL EXHIBITS

TIME SPENT AT EACH EXHIBIT

Visitors at both venues spent the most time in the Jamming Room (median = 5 minutes, 19 seconds), followed by the Music and Memory station (median = 3 minutes) (see Table 6). They spent the least time at Miniature Musicians (median = 19 seconds). In terms of the unique exhibits, NCMNS visitors spent the longest time in the Investigate Lab (median = 9 minutes, 34 seconds); PNNM visitors spent the least time at the introduction panel (median = 9 seconds). No visitors at PNNM stopped at the Discovery Cart

TABLE 6

TIME SPENT AT INDIVIDUAL EXHIBITS: TOTAL SAMPLE

EXHIBIT COMPONENT	NUMBER OF VISITORS WHO STOPPED	MEDIAN TIME (SEC.)
Investigate Lab (NCMNS only)	51	574.0
Jamming Room instrument	119	319.0
Music and Memory visitor feedback station	43	180.0
The Power of Sound and Music Theater	94	147.0
Born Musical interactive	61	146.0
Touchable Sound interactive	51	142.0
Underwater Microphone interactive	75	119.0
Whale Song Structure listening station	33	116.0
Electronic Voice interactive (2 identical stations)	71	113.0
Sea of Sounds listening station	55	98.0
Music at Work listening station	31	94.0
Parabolic Microphone interactive	63	90.0
Watery Music listening station	32	89.5
Xylophone instrument	94	87.0
How Are Animal Sounds like Music? listening station	12	83.5
The Music of Daily Life listening station	33	82.0
Human Voice interactive/Bird Voice interactive	66	78.5
Flutes of the World artifact	46	76.0
Birds in Music listening station/artifact	36	75.0
Thrush Songs listening station/interactive	30	75.0
Music of the Deep listening station	47	71.0
Variety of Whale Songs listening station	57	69.0
Birdsong video	31	67.0
Bird Whistles artifact	31	54.0
Inspired by Animals artifact	39	51.0
Music and Nature listening station	35	46.0
Pictures of Sound listening station	44	44.5
What is Music, Anyway? listening station	47	38.0
Talking Drum artifact	20	26.5
Didgeridoo artifact	25	23.0
Shell Trumpets artifact	37	22.0
Miniature Musicians instrument/artifact	83	19.0
What's This Exhibition About? introduction panel (PNNM only)	3	9.0
Discovery Cart (PNNM only)	0	0.0

Statistical analyses of the time spent at individual exhibits revealed that NCMNS visitors spent more time at seven exhibits (including the Jamming Room) than did PNNM visitors (see Table 6a).

TABLE 6a

DIFFERENCES IN TIME SPENT AT INDIVIDUAL EXHIBITS BY VENUE

EXHIBIT COMPONENT	NCMNS MEDIAN TIME (SEC.)	PNNM MEDIAN TIME (SEC.)	SIGNIFICANCE
Jamming Room instrument	399.0	203.5	Mann-Whitney U = 855.0; p = 0.000
Touchable Sound interactive	225.0	87.0	Mann-Whitney U = 127.5; p = 0.000
Underwater Microphone interactive	191.0	79.5	Mann-Whitney U = 399.5; p = 0.000
Electronic Voice interactive (2 identical stations)	145.5	74.0	Mann-Whitney U = 350.5; p = 0.007
Parabolic Microphone interactive	120.0	35.0	Mann-Whitney U = 127.0; p = 0.000
Human Voice interactive/Bird Voice interactive	105.5	54.5	Mann-Whitney U = 241.0; p = 0.000
Inspired by Animals artifact	73.0	23.0	Mann-Whitney U = 29.0; p = 0.000

STOPS MADE AT EACH EXHIBIT

At both venues, the exhibit at which the most visitors stopped was the Jamming Room (69 percent), followed by the Xylophone (54 percent), and The Power of Sound and Music Theater (54 percent). The fewest visitors stopped at the Talking Drum (12 percent) and How Are Animal Sounds like Music? (7 percent). In terms of the unique exhibits, most NCMNS visitors stopped in the Investigate Lab (69 percent); few PNNM visitors stopped at the introduction panel (3 percent). As noted earlier, no visitors at PNNM stopped at the Discovery Cart.

TABLE 7

PERCENTAGE OF VISITORS WHO STOPPED AT INDIVIDUAL EXHIBITS: TOTAL SAMPLE

EXHIBIT COMPONENT (<i>n</i> = 173)	% VISITORS WHO STOPPED
Investigate Lab (NCMNS only, <i>n</i> = 74)	68.9
Jamming Room instrument	68.8
Xylophone instrument	54.3
The Power of Sound and Music Theater	54.3
Miniature Musicians instrument/artifact	48.0
Underwater Microphone interactive	43.4
Electronic Voice interactive (2 identical stations)	41.0
Human Voice interactive/Bird Voice interactive	38.2
Parabolic Microphone interactive	36.4
Born Musical interactive	35.3
Variety of Whale Songs listening station	32.9
Sea of Sounds listening station	31.8
Touchable Sound interactive	29.5
What is Music, Anyway? listening station	27.2
Music of the Deep listening station	27.2
Flutes of the World artifact	26.6
Pictures of Sound listening station	25.4
Music and Memory visitor feedback station	24.9
Inspired by Animals artifact	22.5
Shell Trumpets artifact	21.4
Birds in Music listening station/artifact	20.8
Music and Nature listening station	20.2
The Music of Daily Life listening station	19.1
Whale Song Structure listening station	19.1
Watery Music listening station	18.5
Bird Whistles artifact	17.9
Birdsong video	17.9
Music at Work listening station	17.9
Thrush Songs listening station/interactive	17.3
Didgeridoo artifact	14.5
Talking Drum artifact	11.6
How Are Animal Sounds like Music? listening station	6.9
What's This Exhibition About? introduction panel (PNNM only, <i>n</i> = 99)	3.0
Discovery Cart (PNNM only, <i>n</i> = 99)	0.0

Statistical analyses of the percentage of visitors who stopped at individual exhibits revealed that NCMNS visitors were more likely to stop at 21 exhibits (including the Jamming Room, The Power of Sound and Music Theater, and the Xylophone) than were PNNM visitors (see Table 7a). Conversely, PNNM visitors were more likely to stop at one exhibit (What is Music, Anyway? listening station) than were NCMNS visitors.

TABLE 7a

DIFFERENCES IN STOPS MADE AT INDIVIDUAL EXHIBITS BY VENUE

EXHIBIT COMPONENT (n = 173)	% NCMNS	% PNNM	SIGNIFICANCE
Jamming Room instrument	87.8	54.5	$\chi^2=21.861$; df=1; p=.000
The Power of Sound and Music Theater	82.4	33.3	$\chi^2=41.144$; df=1; p=.000
Xylophone instrument	81.1	34.3	$\chi^2=37.281$; df=1; p=.000
Parabolic Microphone interactive	64.9	15.2	$\chi^2=45.199$; df=1; p=.000
Electronic Voice interactive (2 identical stations)	62.2	25.3	$\chi^2=23.842$; df=1; p=.000
Underwater Microphone interactive	60.8	30.3	$\chi^2=16.049$; df=1; p=.000
Miniature Musicians instrument/artifact	59.5	39.4	$\chi^2=6.831$; df=1; p=.009
Human Voice interactive/Bird Voice interactive	48.6	30.3	$\chi^2=6.040$; df=1; p=.014
Flutes of the World artifact	45.9	12.1	$\chi^2=24.821$; df=1; p=.000
Sea of Sounds listening station	43.2	23.2	$\chi^2=7.820$; df=1; p=.005
Music of the Deep listening station	37.8	19.2	$\chi^2=7.441$; df=1; p=.006
Inspired by Animals artifact	36.5	12.1	$\chi^2=14.397$; df=1; p=.000
Birds in Music listening station/artifact	36.5	9.1	$\chi^2=19.286$; df=1; p=.000
Pictures of Sound listening station	35.1	18.2	$\chi^2=6.418$; df=1; p=.011
Bird Whistles artifact	31.1	8.1	$\chi^2=15.231$; df=1; p=.000
Whale Song Structure listening station	28.4	12.1	$\chi^2=7.250$; df=1; p=.007
Watery Music listening station	27.0	12.1	$\chi^2=6.241$; df=1; p=.012
Birdsong video	27.0	11.1	$\chi^2=7.293$; df=1; p=.007
Thrush Songs listening station/interactive	27.0	10.1	$\chi^2=8.464$; df=1; p=.004
Didgeridoo artifact	25.7	6.1	$\chi^2=13.179$; df=1; p=.000
Talking Drum artifact	20.3	5.1	$\chi^2=9.594$; df=1; p=.002
What is Music, Anyway? listening station	17.6	34.3	$\chi^2=6.023$; df=1; p=.014

VISITOR BEHAVIORS

Observers noted several possible visitor behaviors, depending on the exhibit. The total incidences of six behaviors appear in Table 8. Detailed information about behaviors at individual exhibits is provided in Appendix E.

Nearly all visitors listened to audio (86 percent), while about three-quarters did activities and discussed exhibit content (77 percent and 72 percent, respectively). A modest percentage of visitors misused exhibits (17 percent), suggesting that the exhibits were engaging and easy to use. Few visitors listened to Spanish audio (1 percent).

TABLE 8
PERCENTAGE OF VISITORS WHO EXHIBITED SPECIFIC BEHAVIORS: TOTAL SAMPLE

BEHAVIOR (n = 173)	TOTAL %
Listen to audio (available at 21 exhibits)*	86.1
Do activity (available at 9 exhibits)	76.9
Discuss exhibit content (applicable to 32 exhibits)	71.7
Listen to audio description (available at 13 exhibits)	35.8
Misuse (applicable at 30 exhibits)	16.8
Listen to Spanish audio (available at 5 exhibits)	1.2

*At 13 exhibits headphones were available. Of visitors who used audio (n = 149), nearly all used headphones (93 percent).

Statistical analyses of visitor behaviors revealed that NCMNS visitors were more likely to listen to audio and do activities than were PNNM visitors (see Table 8a).

TABLE 8a
DIFFERENCES IN BEHAVIORS BY VENUE

BEHAVIOR (n = 173)	NCMNS %	PNNM %
Listen to audio (available at 21 exhibits) ¹	95.9	78.8
Do activity (available at 9 exhibits) ²	91.9	65.7

¹ $\chi^2=10.434$; $df=1$; $p=.001$

² $\chi^2=16.397$; $df=1$; $p=.000$

PRINCIPAL FINDINGS: ONSITE EXIT INTERVIEWS

RK&A conducted onsite interviews at the North Carolina Museum of Natural Sciences (NCMNS) in July and August 2007 and at the Peggy Notebaert Nature Museum (PNNM) in March and April 2008. RK&A interviewed drop-in visitors—individuals and family groups—ages 9 years and older as they exited the *Wild Music* exhibition.

VISITOR DEMOGRAPHICS

NORTH CAROLINA MUSEUM OF NATURAL SCIENCES

At NCMNS, RK&A interviewed 30 visitor groups comprised of 43 individuals (including 31 adults and 12 children). Of the 59 visitors approached, 15 declined to participate, making the refusal rate 25 percent, which is typical for museum studies.

Female interviewees (51 percent) slightly outnumbered male interviewees (49 percent). The adults ranged in age from 18-72 with a median age of 43. The children ranged in age from 3 to 13¹⁰ with a median age of 10.

Fifteen (35 percent) of the 43 interviewees were visiting the NCMNS for the first time and 28 (65 percent) had visited the Museum previously. Of the 28 visitors who had visited the Museum in the past 6 months, nineteen had visited twice, four had visited four times, three had visited three times, one had visited six times, and one had visited ten times.

PEGGY NOTEBAERT NATURE MUSEUM

RK&A conducted 46 individual and group interviews at PNNM—45 in English and one in Spanish. The 46 visitor groups were comprised of 47 visitors (including 40 adults and 7 children). Of 93 visitors approached, 45 declined to participate, making the refusal rate 48 percent, which is high for museum studies. Most visitors said they could not participate because they needed to tend to a child or were anxious to visit other exhibits.

Overall, female interviewees (53 percent) outnumbered male interviewees (47 percent). The adults ranged in age from 20-60 with a median age of 36. The children ranged in age from 9 to 17 with a median age of 14.

Twenty-three (48 percent) of the 47 interviewees had visited the PNNM before the day of the interview and 24 (52 percent) were visiting for the first time. Of the 23 interviewees who had visited the Museum within the past 6 months, thirteen had visited twice, four had visited three times, three had visited six times, one had visited 10 times, one had visited 12 times, and one had visited 13 times. Of the 48 visitors, 40 (85 percent) spoke English as their primary language at home, four spoke Spanish, two spoke French, and two spoke Hebrew at home.

¹⁰ Three children—two 3 year olds and one 6 year old—were younger than the minimum age requirement established in the recruitment protocol. However, they accompanied their caregivers in the interviews and, as such, were included in the sample.

REACTIONS TO THE EXHIBITION

OVERALL OPINIONS OF THE EXHIBITION

When asked their overall opinion of *Wild Music*, most interviewees responded favorably, using terms including “great,” “enjoyable,” “entertaining,” and “informative” to describe the exhibition. Many interviewees praised the exhibits’ interactive, participatory aspects (see the first and second quotations below). In addition, some interviewees offered positive comments about the exhibition’s design and layout (see the third quotation).

(Overall, what’s your opinion of the exhibition?) The fact that you can participate was really nice. Not only were the exhibits hands-on, but they encourage[d] you to participate with the activity and each other too. [NCMNS: female, 57]

I thought it was excellent.... I really liked the fact that there was so much to do and listen to. It was hands-on and you really had to listen. [NCMNS: female, 22]

I really like the design of it, the way it was set up and organized. I noticed the themes woven throughout.... I thought it was well thought through. [PNNM: female, 37]

Some interviewees said the topic of *Wild Music* (i.e., bi music) was engaging and widely appealing (see the first quotation below). Moreover, some interviewees praised the multicultural aspect of the music represented in the exhibition (see the second quotation). A few indicated that their experience in the exhibition helped heighten their listening skills (see the third quotation).

This [the exhibition] is the best thing I’ve seen in a long time. Everyone loves music and nature, so it’s a good subject to pull people in. [PNNM: female, 44]

I liked that there were so many different voices represented, the sounds of many cultures and animals too.... *Kids love music—we all do actually. It’s good to expose them [kids] to different kinds of music, not just the stuff they hear on the radio. [NCMNS: female, 55; male, 57]

It [the exhibition] really helped amplify my attention. I feel like I’m going to walk out of here and listen very carefully to the sounds around me. [PNNM: female, 24]

EXHIBITION HIGH AND LOW POINTS

The interviewers asked interviewees what they liked most about the exhibition. Interviewees appreciated multiple aspects of the exhibition. Many said they liked the Jamming Room best, praising the open-ended quality of the experience and diverse array of instruments available (see the first and second quotations below). Many also responded favorably to the animal sounds featured in *Wild Music*, specifically whales and birds (see the third and fourth quotations), but also in a more general sense of simply appreciating natural sounds (see the fifth quotation). A few said they enjoyed the exhibits that provided an opportunity to hear and feel sound vibrations (see the sixth quotation).

(What did you like most about the exhibition?) The music room was really cool. The fact that you could do whatever you wanted in there. It was sort of just open, free-form. It was nice to have an exhibit you could really get into. [PNNM: female, 22].

It was neat that you could make so many different kinds of sounds, with instruments from all over. [NCMNS, female, 37]

I loved the whale sounds. (What makes you say that?) I have an affinity for the sea; I just find the whale sounds so soothing. [PNNM, female, 44]

It seems like I don't really notice the birds, so it was cool to listen to the birdcalls and try to identify them. [PNNM: male, 48]

I live in the city, so it's good to hear sounds that you don't hear every day, the animal sounds.... I miss nature. [PNNM: female, 59]

I thought it was really great that you could not only hear the sounds but also see and touch the vibrations. It made me realize that music is more than what you hear. [NCMNS: male, 44]

When asked what their least favorite aspect of the exhibition was, many interviewees said, "nothing." In contrast, some interviewees indicated that they were overwhelmed by the density of exhibit experiences (see the first quotation below). Several reacted negatively to the exhibits that required the use of headphones (see the second quotation). In addition, a few interviewees who were accompanied by toddlers complained that the exhibition did not accommodate young children in its design or its content (see third and fourth quotations).

It was a little much. There's just too much to do. I found myself really distracted...bouncing from one thing to the next. [NCMNS: female, 53]

I didn't like the ones [exhibits] where you had to use the headphones. They [headphones] are hard for young kids to use, and I'm always concerned about catching something. [NCMNS: female, 48]

There was a lot of reading... it was too old for my kids. There's just not enough for young kids. [PNNM: female, 40]

Some of the exhibits seemed too tall; the kids couldn't really reach. [NCMNS: male, 33]

USE OF AND REACTIONS TO JAMMING ROOM EXPERIENCE

The interviewers asked interviewees if they visited the Jamming Room while in the exhibition. Many interviewees said they did not visit the Jamming Room and offered a variety of reasons for bypassing this exhibit. Some simply cited lack of time as the reason. Some purposefully bypassed this exhibit: several because of crowding and noise and several others because of discomfort sharing the enclosed space with strangers (see the first three quotations below). A few commented on the high energy level of the older children using the room and said they assumed the activities were not geared to younger children (see the fourth quotation). A few others said they did not notice the Jamming Room while visiting the exhibition; two said they were unsure what the room was when they passed it, and, therefore, did not stop.

(Did you happen to visit the enclosed room with all the different instruments and sound-making devises?) Well, we noticed that room, but it looked like folks were getting pretty involved in there. We didn't stop; we just didn't have time. [NCMNS: female, 33]

There were a lot of people in there when I passed it [the Jamming Room].... It looked kind of crowded, so I skipped it. [PNNM: male, 53]

No [I did not visit the Jamming Room] because I didn't want to feel stuck. I didn't know the other people who were in there, so I guess I didn't want to commit. [NCMNS: male, 44]

No, we didn't go in there [the Jamming Room]. It looked like the kids were going crazy in there. It looked like a rowdy space not suited for my toddler. [PNNM: female, 36]

In contrast, some interviewees reported visiting the Jamming Room, and of those, nearly all said that they used a variety of instruments in the room. When asked to describe the Jamming Room's main message, most commented on the diversity of music and the connection between music and nature (see the first and second quotations below). Several said that the Jamming Room gave visitors an opportunity to collaborate in making music together (see the third quotation).

Messing around with all those instruments reminds us that there are lots of different kinds of music in the world including the music of nature. [NCMNS: male, 44]

(What do you think that room is trying to show or tell visitors?) Music is everywhere—in nature and every culture. [PNNM: female, 25]

Well, it seemed that it [the Jamming Room] was trying to get people to jam... to collaborate and make music together. I'm not sure people, strangers, were that into coming together as a group, but I think that's what the stuff in the room was trying to do. [PNNM: male, 29]

REACTIONS TO THE SOUND ENVIRONMENT

ENGAGEMENT OF LISTENING SKILLS AND RESPONSES TO SPECIFIC SOUNDS

The interviewers asked interviewees to name some of the sounds they heard in the exhibition. Many interviewees cited nature sounds including whale songs and birdcalls, whereas some others cited musical instruments including drums, the didgeridoo, the xylophone, and flutes. Similarly, when asked which sounds in the exhibition they thought were the most interesting, interviewees cited underwater sounds, whale songs, and instruments in the Jamming Room most frequently (see the first, second, and third quotations below). Some interviewees said they thought the birdcalls were most interesting (see the fourth quotation) while a few expressed a strong interest in “touchable sound” (see the fifth quotation).

(What would you say were some of the most interesting sounds you heard [in the exhibition]?) I listened to the stuff in the tank, like the props and the fish... I thought all those underwater sounds were interesting. I didn't know it was so noisy down there [in the ocean]. [NCMNS: male, 62]

I was most surprised by the blue whale sound. It sounded so different from the typical whale sounds I've heard, like, a humpback that is so deep and so low.... It hadn't occurred to me that an animal would sound like that. I didn't realize there were so many whale sounds. [NCMNS: female, 48]

I'm fascinated by the sounds all those different types of instruments make. The instruments in that enclosed space [the Jamming Room] and all the ones from around the world are interesting. [PNNM: male, 42]

(What would you say were some of the most interesting sounds you heard [in the exhibition]?) The birds. (What about bird sounds is interesting to you?) Not only are there so many different

sizes and colors, their sounds are unique as well. It's pretty amazing that they have hundreds of different melodies. [PNNM: male, 37]

I'd say being able to touch sound [Touchable Sound exhibit] was engaging. (What about it was engaging?) Because it had all the senses—you were looking at the sound, feeling the sound, as well as hearing it. [NCMNS: female, 44]

When asked which sounds in the exhibition were personally relevant to them, again, many interviewees cited nature sounds including those of whales and birds (see the first and second quotations below). Some interviewees mentioned specific instruments that had personal meaning to them or stimulated memories including the xylophone and drums (see the third quotation). A few referenced their experience in the Jamming Room and said that the cultural aspect of music was relevant to them (see the fourth quotation). In addition, a few interviewees said that they could relate to the “music while you work” exhibit owing to past experiences (see the fifth quotation).

(Which sounds, if any, did you find personally relevant or meaningful?) Whales—I love the sound of whales. We live on an elk farm.... The first time I heard elk, I thought they sounded like whales. I get reminded of whales every spring when the elk are in rut. [PNNM: male, 60]

The bird sounds.... We live near a lot of trees, so it kind of reminds me of waking up in the morning. I get to wake up to birdcalls, which is kind of nice.... I'm reminded that we're all connected...you know, with nature. [NCMNS: female, 28]

The xylophone brings back memories.... Our daughter played the xylophone when she was in a band. She loved it.... It just makes me think of her and wish she was here. [PNNM: female, 57]

I'd have to go with the sound room [Jamming Room] because I like anything with rhythm. (In what way are those sounds personally relevant to you?) I think it's the cultural part, the ritualistic side of music. Although I've never been to Africa, I can hear the pulse...the rhythm that is such a strong pull and meaning for me culturally. [PNNM: male, 42]

I really enjoyed listening to the music of the workers [Music at Work listening station], the postal workers and all that. I guess I could relate.... I was in India doing a film and women were cutting reeds, and they were singing in the field. I didn't really notice it at the time because I was busy making the film. But when I got back and looked at the scene, I realized they were singing while they were chopping the reeds. It all was very rhythmic. [PNNM: male, 46]

REACTIONS TO EXHIBIT SOUND LEVELS AND AMBIENT NOISE

When asked what problems they had listening at the exhibits, most interviewees reported no difficulties. However, several reacted negatively to the use of headphones in the exhibition. Some cited lack of social interaction and sanitary concerns associated with headphone use (see the first two quotations below). A few reported that some of the headphones were not working when they visited the exhibition (see the third quotation). A few others said that they did not like listening to the audio instructions that accompanied many of the exhibits (see the fourth quotation). Of those interviewees, none identified themselves as hearing-impaired or acknowledged the value of audio instructions for those who are deaf.

I had a lot of resistance to putting on the headphones. (What makes you say that?) I guess I'm a 'germaphobe'.... I just don't like the idea of sharing headphones with a crowd full of strangers. [NCMNS: female, 48]

I didn't like that, at some of them [the exhibits], you couldn't share with friends because they required headphones. You can't interact very well.... I feel isolated. [PNNM: male, 33]

Not all of the headphones were working. For some, the volume control didn't always function well. I couldn't get the headphones to be quiet enough. I don't need the sound to be blaring, but the majority of people in the world like to crank it up. [NCMNS: female, 40]

I didn't really like listening to the directions. With some of them [the exhibits], you couldn't turn off the narration. *Yeah, you can't really stop them once you've pressed the button...and they [audio instruction] say the same stuff that you can read only it takes more time to listen. [NCMNS: female, 44; male, 11]

Most interviewees' comments indicated that sound bleed from neighboring exhibits did not hinder their ability to use the respective exhibit components. Although many said they could hear competing sounds in the exhibition, all but two said the noise did not bother them (see the quotation below). Two NCMNS interviewees reported having difficulty hearing birdcalls at an exhibit because of sound coming from adjacent interactive exhibits.

(Some visitors I've talked with said that when they were using one exhibit they could hear sounds coming from another exhibit. What do you think about that?) Yes, of course, I could hear sounds coming from the other parts [of the exhibition], but it didn't bother me. The exhibit is about music, after all. The entire thing is based on sounds and noises. [NCMNS: male, 22]

RESPONSES TO ENVIRONMENTAL SOUNDSCAPES

The interviewer asked interviewees whether they noticed the ambient sounds playing throughout the exhibition. About two-thirds of interviewees said they heard the soundscape playing in the background. Of those interviewees, many said they had listened attentively to the ambient sound and described what they heard as general "nature sounds" or more specifically as "birdcalls," "the jungle," or "the rainforest" (see the first quotation below), while some said they did not pay much attention to it (see the second quotation). In contrast, one-third of interviewees said they did not notice the ambient sound.

You mean the whole nature thing going on in the background? Yeah, I noticed it. (How would you describe that sound?) It sounded like being deep in the jungle. [PNNM: female, 43]

(Did you happen to notice the ambient sounds playing through the exhibition?) I guess I noticed it, but, to tell you the truth, I didn't really pay much attention to it. I thought it was just ambient noise coming from the other booths rather than a distinct soundtrack. [NCMNS: female, 53]

Some interviewees used terms such as "peaceful," "serene," "comforting," "calming," "relaxing," and "subtle" to describe the ambient sound (see the first quotation below). However, a few did not respond favorably to the soundscape, describing the sound as "irritating," "annoying," or "distracting" (see the second quotation).

I hadn't really paid attention to it until I came back in here [the exhibition] a second time—it's very subtle. I found the sound of birds and the forest soothing and quite relaxing. [NCMNS: female, 44]

Yeah, I heard that sound, which kind of sounded like birds. But there was so much going on in there [the exhibition] that, to tell you the truth, I found the ambient sound annoying. It wasn't really necessary and didn't really add to the whole thing. [PNNM: male, 34]

Understanding of Exhibition conTent

CONVEYANCE OF MAIN MESSAGE

When asked what the *Wild Music* exhibition was about, most interviewees simply said “sound” or “music.” However, when further queried, many interviewees said that the exhibition was about attentive listening (see the first and second quotations below). Some said that the main message was that music is everywhere (see the third quotation). Several interviewees said the exhibition was about the ways animals communicate (see the fourth quotation). In addition, a few said that the exhibition was about the origins and evolution of music (see the fifth quotation).

It's about paying attention to the different sounds that everything makes in nature. It's not just people that make music.... If we listen carefully, we can hear all of the music in nature. [NCMNS: female, 43]

The point [of the exhibition] is that it's important to listen.... I'm sure I hear bird sounds every day, but I never really listen that closely to notice their different melodies. [PNNM: female, 44]

It strikes me that the message it [the exhibition] was trying to convey is that there are sounds everywhere... under ground, under water... everywhere. Even a car backfiring can be music. [NCMNS: female, 18]

[The exhibition is about] the way animals communicate.... We create music to listen to and enjoy. They [other animals] create music to communicate.... But we also communicate with music, like with drums and the, what's that called, the didgeridoo? [NCMNS: male, 28]

It [the exhibition] is showing you where music comes from. Music has been around for a long time. I think our [human] music is derived from the music in nature. We didn't invent it, nature did. We just still produce it [music], and it changes over time. Everything is connected through music. [PNNM: female, 57]

INTERVIEWEE'S COGNITIVE AND AFFECTIVE EXPERIENCES

Interviewers asked interviewees to share some of the ideas, feelings or messages they took away from the exhibition. As noted earlier, many interviewees said the exhibition reminded them to listen more attentively (see the first and second quotations below). Some interviewees said that the exhibition made them appreciate the complexity of sound (see the third quotation).

I think what I took away from it [the exhibition] was to pay more attention to specific sounds and not just let them all blend into the background. [NCMNS: male, 14]

I think it's really just about listening and not taking sounds for granted.... Listen to your surroundings a little bit more. [PNNM: male, 39]

There are a lot of things in sound. I guess the sounds we hear are more complicated than we realize. (Can you give me an example?). Well, the one [exhibit] where you hear the birdsongs at full speed, which is what you normally hear, then you can slow them down and hear all the

notes. It's really quite complicated.... You don't realize that it's probably as complex as speech. [NCMNS: female, 44]

A few interviewees' comments indicated that listening to nature sounds in the exhibition made them realize how disconnected they felt from nature in their everyday lives (see first quotation below). Moreover, a few interviewees said that the exhibition made them consider that the definition of music is subjective and based on a person's interpretation of sound (see the second and third quotations).

I got the feeling of how we miss nature... In an urban setting, it's very difficult to benefit from being face-to-face with nature. I feel disconnected. [PNNM: male, 38]

What I took away from it [the exhibition] is that music can be anything for anyone. It depends on what your definition of music is. Sound can be interpreted in different ways.... You could just play a random sound, and it could be music. [NCMNS: female, 37]

One of the things that struck me was that exhibit about elephants, where the ethnobiologist talked about why we define the elephant concert as music.... It's because we have to interpret it. The artist is actually the person that's taking the sound and saying it is music. [NCMNS: female, 53]

HOW MUSIC CONNECTS TO OTHER LIVING THINGS

When asked how music connects humans to other living things, many interviewees said humans and other animals make sounds that can be interpreted as music (see the first quotation below). Similarly, many interviewees added that humans and other animals make musical sounds to communicate with each other (see the second quotation). Several said that humans mimic nature sounds and suggested that this was an example of how nature connects humans to the rest of the living world (see the third quotation). In contrast, a few interviewees were unsure how music connects humans to other living things.

I guess everything can sorta make a musical sound like people can, so I guess that's how music would connect us to birds or squirrels and stuff.... It [the exhibition] is basically showing that humans aren't the only ones that can create music. [NCMNS: male, 13]

[In what ways, if any, does music connect humans to other living things?] Well, we create music to listen to and enjoy. They [animals] create it [music] in order to communicate, but we can also use music to communicate like with the drums and other instruments used by different cultures. Music is the universal language. [PNNM: female, 44]

Well, music connects us all because we borrow from nature. People first made music because they heard sounds in nature that they were trying to re-create. I think music, the first music, was an imitation of the sounds that are heard in nature. [NCMNS: male, 38]

The interviewer explicitly asked interviewees what living things other than humans make music. As mentioned previously, many interviewees said that every living thing makes music in one form or another (see the first quotation below). Some cited specific animals that, in their opinion, make music including "whales," "birds," and "crickets." When asked how the music of humans is like that of other living things, most said that all music is a form of communication (see the second quotation). Some said that humans imitate the sounds of nature (see the third quotation).

Birds, whales, all animals... I mean it depends on how you look at it. All living things make some sort of sound that can be interpreted as music. [PNNM: female, 30]

I guess they [humans and other animals] use it [music] for communication.... A lot of times, the whales are communicating through the sounds that they make. I think a lot of times humans have evolved music to be a form of communication with others. [NCMNS: female, 57]

The first music was the imitation of the sounds that our early ancestors heard in nature. [NCMNS: female, 44]

UNDERSTANDING OF THE STUDY OF BIOMUSIC

The interviewer asked interviewees what, if anything, they learned in the exhibition about how people are studying music and sound. Nearly two-thirds of interviewees said they were unsure and indicated that they either did not see or did not pay attention to information in the exhibition about musicology or acoustics (see the quotation below).

(What, if anything, did you find out about how people are studying music and other sounds?)
I don't really know. I guess I didn't pay that much attention to the science part. [PNNM: female, 17]

Of the one-third of interviewees who gleaned information about the study of music, most discussed animal communication (see the first and second quotations below). Several noted that the scientific study of music and sound is diverse and that researchers have varying opinions about what constitutes music (see the third and fourth quotations). Others gave idiosyncratic responses. For example, one interviewee said he learned what an "aquaphone" is. Another commented that "the study of bird sounds must require a great deal of patience."

I found out that ... studying bird sounds is really interesting—how they [people studying bird sounds] wrote about conversations and how they noticed repetition in bird sounds. It just relates it back to our own way of communication, primordial communication. [PNNM: female, 34]

I loved that there's research on what the different bird sounds are saying. I found it interesting that they would show how a bird says 'stay away from me' and 'come to me.' It's fascinating that they are able to decipher that level of communication; there actually is communication in those sounds. [PNNM: female, 46]

I think that there's a variety of approaches that people take to study sound. It was interesting to hear someone who was an Eskimo talk about music and how it related to his culture. And then there was another woman who was an ethnomusicologist who had a different perspective about what music is.... Then there was the sound environment guy; he referred to the monkeys or apes that hear bones moving. There's just a variety of different angles to this diverse subject. [PNNM: female, 28]

They [researchers] have varying opinions of what music is. For some, what I hear as music, they don't hear as music. I thought that was fascinating that there's not really a consensus of what music is. You'd think with the discipline they would at least have a definition, but it didn't seem like they did. [NCMNS: female, 44]

APPENDICES

APPENDIX A

SMM *WILD MUSIC* LEARNING OUTCOMES

Overall Learning Goal:

Musical sounds are the universal communication medium found in many species, from insects to mammals. Throughout the living world, the capacity to make, hear, and respond to musical sounds is fundamental and inborn.

Visitor experience objectives:

1. Visitors will refine their listening skills and identify sounds in the exhibition that were meaningful to them, and explain why.
2. Visitors will be able to describe at least two of the interdisciplinary sciences involved in the study of biomusic.
3. Visitors will give two examples of how music connects us to other living things.
4. Visitors will identify two lines of evidence indicating the ancient origins of music.
5. Visitors' descriptions of music will include natural soundscapes.
6. Visitors' perception of music will be enriched as indicated by their use of specific terminology to describe musical sounds.

APPENDIX B: OBSERVATION FORM, NCMNS AND PNNM

REMOVED FOR PROPRIETARY PURPOSES

APPENDIX C: INTERVIEW GUIDE

REMOVED FOR PROPRIETARY PURPOSE

APPENDIX D: LIST OF STATISTICS

STATISTICAL ANALYSES RUN ON OBSERVATIONAL DATA

Chi-square Statistic

All demographic characteristics and data collection characteristics X Venue (NCMNH or PNNM)

Gender X Percentage of visitors that stopped at each exhibit
Ages (3 groups) Percentage of visitors that exhibited 6 behaviors
Visiting with children
Venue (NCMNH or PNNM)

ANOVA/Mann-Whitney U

Gender X Total time
Ages (3 groups) Total stops
Visiting with children Time spent at each exhibit
Venue (NCMNH or PNNM)

APPENDIX E

VISITOR BEHAVIORS FOR EACH EXHIBIT (BY SECTION)

EDGE OF THE FOREST

Exhibit Name	Number of Visitors who Stopped	Number of Visitors who Displayed Behavior
Miniature Musicians instrument/artifact	44	Discuss = 17 Use audio = 9 Play instrument = 37 Point to/touch artifact = 15 Misuse = 6 Broken = 0
Pictures of Sound listening station	26	Discuss = 7 Audio description = 6 Use audio = 21 (Median number used = 3) Touch spectrogram = 16 Misuse = 2 Broken = 0
Investigate Lab (NCMNS)	51	Never closed during data collection period
Birds in Music listening station/artifact*	27	Discuss = 6 Audio description = 1 Use audio = 23 (Median number used = 2) Point to/touch artifact = 7 Misuse = 5 Broken = 0
Didgeradoo artifact	19	Discuss = 4 Use audio = 13 Point to/touch artifact = 3 Misuse = 0 Broken = 0
Music and Nature listening station	20	Discuss = 8 Spanish = 0 Use audio = 18 (Median number used = 3) Misuse = 3 Broken = 0
Talking Drum artifact	15	Discuss = 9 Use audio = 9 Point to/touch artifact = 6 Misuse = 2 Broken = 0
Inspired by Animals artifact	27	Discuss = 11 Audio description = 4 Use audio = 20 (Median number used = 3) Point to/touch artifact = 7 Misuse = 1 Broken = 0
Flutes of the World artifact	34	Discuss = 8 Audio description = 3 Use audio = 30 (Median number used = 4) Point to/touch artifact = 10 Misuse = 0 Broken = 0
Bird Whistles artifact	23	Discuss = 4 Audio description = 6 Use audio = 17 (Median number used = 3) Point to/touch artifact = 6 Misuse = 0 Broken = 0

Exhibit Name	Number of Visitors who Stopped	Number of Visitors who Displayed Behavior
Parabolic Microphone interactive	48	Discuss = 17 Audio description = 9 Do activity = 41 (Alone = 23/Group = 18) Notice panel = 28 Misuse = 1 Broken = 0
Bird Song video	20	Discuss = 4 Spanish = 0 Use audio = 13 (Median number used = 2) Misuse = 0 Broken = 0
Thrush Songs listening station/interactive	20	Discuss = 3 Touch spectrogram = 0 Do activity = 10 (Alone = 6/Group = 4) Use audio = 15 (Median number used = 4) Misuse = 0 Broken = 0
Xylophone instrument	60	Discuss = 18 Audio description = 9 Play instrument = 48 Notice panel = 27 Misuse = 1 Broken = 0

POWER OF MUSIC

Exhibit Name	Number of Visitors who Stopped	Number of Visitors who Displayed Behavior
The Power of Sound and Music Theater	61	Discuss = 18 Broken = 0
What is Music, Anyway? listening station	13	Discuss = 5 Spanish = 1 Use audio = 8 (Median number used = 1) Notice panel = 7 Misuse = 0 Broken = 1
How Are Animal Sounds like Music? listening station	7	Discuss = 2 Spanish = 0 Use audio = 6 (Median number used = 2) Notice panel = 4 Misuse = 0 Broken = 0

BIOACOUSTICS LABORATORY

Exhibit Name	Number of Visitors who Stopped	Number of Visitors who Displayed Behavior
Human Voice interactive/Bird Voice interactive	36	Discuss = 20 Audio description = 12 Do Human activity = 30 (Alone =9/Group = 21) Do Bird activity = 29 (Alone = 7/Group = 22) Misuse = 0 Broken = 0
Electronic Voice interactive (2 identical stations)	46	Discuss = 19 Audio description = 6 Do activity = 44 (Alone =8/Group = 36) Misuse = 1 Broken = 3
Touchable Sound interactive	28	Discuss = 10 Audio description = 4 Do activity = 24 (Alone =3/Group = 21) Misuse = 4 Broken = 0
Discovery Cart	0	

THE TOWN/URBAN SCENE

Exhibit Name	Number of Visitors who Stopped	Number of Visitors who Displayed Behavior
Born Musical interactive	33	Discuss= 9 Do activity = 24 (Alone =8/Group = 16) Misuse = 0 Broken = 0
Music and Memory visitor feedback station	25	Discuss = 6 Record video(s) = 9 (Alone =1/Group = 8) Watch video(s) = 20 (Alone =5/Group = 15) Misuse = 2 Broken = 0
The Music of Daily Life listening station	20	Discuss = 4 Use audio = 14 (Median number used = 2) Misuse = 0 Broken = 0
Music at Work listening station	11	Discuss = 4 Use audio = 10 (Median number used = 6) Misuse = 0 Broken = 0
Jamming Room instrument	65	Play instruments = 58 Others in room = 58 Misuse = 1 Jamming Room was never closed during data collection.

OCEAN DEEPS

Exhibit Name	Number of Visitors who Stopped	Number of Visitors who Displayed Behavior
Shell Trumpets artifact	21	Discuss = 3 Use audio = 21 Point to/touch artifact = 4 Misuse = 0 Broken = 0
Music of the Deep listening station	28	Discuss = 5 Audio description = 6 Use audio = 21 Touch spectrogram = 17 Misuse = 1 Broken = 0
Whale Song Structure listening station	21	Discuss = 4 Audio description = 3 Use audio = 19 (Median number used = 6) Misuse = 0 Broken = 0
Underwater Microphone interactive	45	Discuss = 15 Audio description = 4 Do activity = 37 (Alone =5/Group = 32) Point to/touch artifact = 5 Misuse = 1 Broken = 0
Sea of Sounds listening station	32	Discuss = 7 Use audio = 24 (Median number used = 5) Point to/touch artifact = 4 Misuse = 1 Broken = 0
Watery Music listening station	20	Discuss = 4 Spanish = 0 Use audio = 16 (Median number used = 3) Misuse = 0 Broken = 0
Variety of Whale Songs listening station	27	Discuss = 6 Use audio = 24 (Median number used = 4) Use flipbook = 8 Misuse = 0 Broken = 0