



Museum Visitor Studies, Evaluation & Audience Research

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Exhibition Evaluation

Summative Evaluation of *Cyberchase: The Chase Is On!*

Prepared for the
**Children's Museum of Houston
Houston, TX**

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DISCUSSION

The Children’s Museum of Houston (CMH) has created rich and vibrant visitor experiences for children and families through *Cyberchase: The Chase is On!* Findings show that visitors’ experiences in *Cyberchase* were engaging and educational, especially for children in the target age group, 5 to 12 years. Most notably, the majority of adults and children demonstrated some understanding of two key exhibition messages—“Math is a way of thinking and everyone can be successful at it,” as well as “We use math every day.” Further, visitors appreciated the Spanish labels and were excited by the use of the *Cyberchase* brand, a television show popular with young children. Though *Cyberchase* visits were not lengthy—the median time was 7 minutes—it seems factors other than time spent in the exhibition had a greater influence on the visitor experience. This discussion examines these findings and their implications.

EXHIBIT COMPONENTS WERE WELL-DESIGNED AND APPROPRIATE FOR THE AUDIENCE

Overall, visitors’ opinions of the exhibition were positive; they enjoyed the many interactive exhibits and were sensitive to its key messages. The use of multimedia—video, computers, and low-tech interactive components—can engage visitors in multilayered activities and encourage and support interaction (McLean, 1993). It is no surprise then, that family groups enjoyed *Cyberchase* for its interactive components.

Most notably, adults and children appreciated that the exhibit components created challenges that allowed children to “succeed” or “win,” leaving them with a sense of accomplishment. Parents praised the exhibition for translating complicated math content into simple, fun exhibits. The fact that visitors felt they could succeed in the exhibition indicates that *Cyberchase* was user-friendly; too often science exhibits are difficult to use and understand, leaving visitors frustrated and dissatisfied. Less than one-half of visitors misused an exhibit in *Cyberchase* (only 39 percent), again suggesting that the exhibits were accessible to its target age group. It is worth exhibit developers’ time to examine these exhibits to tease out what makes them successful and to use that knowledge to inform future exhibitions.

CYBERCHASE’S MATH THEME WAS UNDERSTOOD BY MOST ADULTS AND CHILDREN

At the center of any well-crafted exhibition are key messages. Naturally, exhibition developers hope that visitors will walk away from an exhibition understanding these messages. Conveying messages, especially those with complicated content like math, is difficult. Yet, the majority of adults and children who visited *Cyberchase* understood that the exhibition was about math, particularly its use in everyday life, and were able to cite specific examples from the exhibition. Furthermore, stationed observations (in-depth observation lasting at least two hours) of two exhibits revealed a variety of mathematics-related language and behaviors. This is no easy feat; an evaluation of another children’s math exhibition showed that it is difficult to convey math content to parents since they may not understand the broad application of mathematics beyond simple arithmetic, especially as it relates to young children (RK&A, 2000).

An examination of the exhibition reveals two factors that may have contributed to high visitor understanding. As mentioned previously, the individual exhibit components were enjoyed and used correctly by most visitors. Because most of the exhibits were set up as challenges, visitors came to an understanding of each exhibit’s message as they tackled and solved each imaginary problem. Also, using a popular children’s television show, *Cyberchase*, as an entry point, allowed visitors to enter a familiar

space. The majority of visitors appreciated the *Cyberchase* brand; their familiarity gave them an upper hand in that they knew the primary thesis of the show is using math to solve problems. In a way, previous knowledge of the television show served as an advanced organizer, telling visitors what to expect in the exhibition.

ADULT-CHILD INTERACTION WAS HIGH

Both tracking and stationed observations showed that parents in the exhibition were actively involved with their children's experiences. The exhibits fostered coaching in a majority of visiting groups (60 percent), and this behavior is associated with learning in museums (Borun, et. al., 1996). A review of summative evaluations of other science exhibitions shows that this behavior was more prevalent in *Cyberchase*. For example, in an exhibition about cellular biology, coaching behavior was observed in 36 percent of groups, and in an exhibition about tissues, it was observed in 22 percent (2003a, and 2004b). Comparisons such as these are inconclusive since each exhibition and evaluation is unique^{*}; however, the comparison does provide a frame of reference and cause one to speculate on why coaching was so high in *Cyberchase*. One explanation may simply be demographics. *Cyberchase* was visited most often by families when compared with the two examples cited above (57 percent, and 67 percent, respectively). Another explanation may be the exhibits themselves. Again, the challenge aspect of each exhibit may have fostered a kind of teamwork that other types of exhibits do not.

^{*} Very little timing and tracking data exists for exhibitions in children's museums, thus it is difficult to make conclusive comparisons.

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EXECUTIVE SUMMARY

This report presents the findings from a summative evaluation, of the National Science Foundation-funded exhibition *Cyberchase: The Chase Is On!* conducted by Randi Korn & Associates, Inc. (RK&A) for the Children’s Museum of Houston (CMH) in Houston, Texas. The Museum developed the exhibition for travel, and data collection took place in Houston during April 2007 and at the New York Hall of Science in Queens, New York during November/December 2007. The evaluation documents the exhibition’s impact and effectiveness using timing and tracking observations, exit interviews, and stationed observations (Houston only).

**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

Data were collected at the Children’s Museum of Houston (CMH) in Houston, Texas and the New York Hall of Science (NYHS) in Queens, New York. The evaluators observed a total of 200 drop-in visitors between the age of 5 and 10 years old (100 at CMH and 100 at NYHS).

VISITOR DESCRIPTIONS

- ◆ The total sample of visitors observed included nearly equal numbers of males and females (51 percent and 49 percent, respectively).
- ◆ Nearly equal numbers of visitors were between the ages of 5 to 7 (51 percent) and 8 to 10 (49 percent).
- ◆ The majority of visitors spoke English. Nine percent used Spanish as their first language while in the exhibition.
- ◆ On average, each observed child was accompanied by one other child and one adult. More than one-half were accompanied by children ages 7 and under (58 percent).

OVERALL VISITATION PATTERNS

- ◆ Visitors’ total time in the exhibition (both sites combined) ranged from 23 seconds to one hour, with a median time of seven minutes*.
- ◆ At both sites, the median number of exhibits visitors stopped at was five.
- ◆ Younger visitors ages 5 to 7 stopped at more exhibits than did older visitors ages 8 to 10.

*Little timing and tracking data exists on children’s museum exhibitions. *Cyberchase: The Chase Is On!* had a similar median total time in comparison to CMH’s *Scholastic’s Magic School Bus Kicks Up a Storm*, an exhibit that, while 40 percent larger, is also based around a known commodity with a similarly-aged target audience base. As such, any discrepancy between *Cyberchase* and data from non-children’s museums’ exhibitions most likely reflects the behaviors of children in a children’s museum rather than the merit of the exhibition itself.

VISITATION TO INDIVIDUAL EXHIBITS

- ◆ Visitors spent the most time at Restore the Power, followed by Jimayan Mystery, Aim is the Game, and Playing with Patterns.
- ◆ The exhibits at which the most visitors stopped were the Magnetite Rocket, Aim is the Game, and Playing with Patterns.

VISITOR BEHAVIORS

- ◆ Slightly less than two-thirds of all visitors were coached by an adult (61 percent).
- ◆ 46 percent of visitors interacted verbally with others.
- ◆ 39 percent of visitors misused an exhibit.
- ◆ 3 percent of visitors listened to an exhibit component in Spanish.
- ◆ Children ages 5 to 7 were more likely to be coached by an adult than were children ages 8 to 10.

PRINCIPAL FINDINGS: ADULT EXIT INTERVIEWS

RK&A conducted interviews with a random sample of visitors after they exited the *Cyberchase* exhibition at CMH in April 2007 and NYHS in November/December 2007. Interviews were conducted with 56 adults visiting with at least one child between 5 and 10 years old.

VISITOR DEMOGRAPHICS

- ◆ Approximately two-thirds of interviewees were female ($n = 37$) and about one-quarter of interviewees were bilingual or Spanish-speaking ($n = 15$). The median age of adults interviewed was 40 years old.

OVERALL VISITOR OPINIONS

- ◆ Most interviewees said something positive about the exhibition and about one-half of adults praised its educational or interactive nature.
- ◆ Slightly more than one-third of interviewees said they most enjoyed the exhibition's ability to engage their child or its kid-friendly design.
- ◆ Approximately one-third of interviewees named the Power-up Station Bicycle or Hand crank and Restore the Power as their child's favorite exhibit.
- ◆ Two-thirds of interviewees said the *Cyberchase* brand positively affected their opinion of the exhibition and most of these said their child enjoyed the exhibition more because it was *Cyberchase*.

CONVEYING THE CONTENT

- ◆ Without prompting, one-half of interviewees spoke about the exhibition's main idea in terms of math. Of those who discussed math, one-half said the exhibition was trying to teach math or science concepts in a general way, and the other one-half said the exhibition was specifically trying to show how math can be used in everyday life or that math can be fun.
- ◆ When probed specifically about math, most interviewees named at least one thing in the exhibition that related to everyday math used at home, work, or school in addition to at least one general math skill their child used.

- ◆ About one-third of interviewees said Restore the Power or Poddle Family Patterns related to everyday math and were exhibits where their children used math.
- ◆ The majority of interviewees spoke positively about the exhibition’s bilingual labels.

PRINCIPAL FINDINGS: CHILD EXIT INTERVIEWS

RK&A conducted in-depth interviews with children who visited *Cyberchase* after they exited the exhibition at CMH in April 2007 and NYHS in December 2007. Interviews were conducted with 63 children—30 at CMH and 33 at NYHS.

VISITOR DEMOGRAPHICS

- ◆ Slightly more than one-half of interviewees were female ($n = 33$) and about one-quarter were bilingual or Spanish-speaking ($n = 15$). The median age of children interviewed was 7 years old.

OVERALL VISITOR OPINIONS

- ◆ Approximately one-third of all children said they liked Aim is the Game or the Power-up Station Bicycle the best.
- ◆ Children chose their favorite exhibit for different reasons. Some enjoyed the hands-on, interactive nature of an exhibit and several children said they liked problem-solving or succeeding (i.e., “winning”).

UNDERSTANDING OF EXHIBITION CONTENT

- ◆ When asked specifically about math, slightly less than one-half of interviewees said they did something math-related as part of their *Cyberchase* experience.
- ◆ When interviewers probed children further while showing them exhibit photographs, the majority mentioned doing math in the Poddleville exhibit.
- ◆ Children were asked to describe an activity from the exhibition that reminded them of math they do at home or school, and two-thirds were able to do so.
- ◆ Interviewees were asked to complete two sentences: “Before seeing this exhibit, math made me feel. . .” and “After seeing this exhibit, math makes me feel. . .” Most children had a positive shift in their feelings about math after seeing the exhibition.
- ◆ Approximately two-thirds of all interviewees—at CMH and NYHS—noticed the bilingual labels. Of these interviewees, about one-half said they were a good idea.

PRINCIPAL FINDINGS: STATIONED OBSERVATIONS

BACKGROUND

- ◆ RK&A observed a total of 178 visitors at the two exhibits, 93 at Playing with Patterns and 85 at Restore the Power, during four hours on a Saturday afternoon.*

* RK&A chose to observe visitors at these two exhibits because Museum staff identified them as the most frequently used in the *Cyberchase* exhibition.

PLAYING WITH PATTERNS EXHIBIT

- ◆ Children were drawn to the Playing with Patterns exhibit, typically calling over adults and/or other children in their visit groups to join them.
- ◆ Creating a music pattern was always a shared or collaborative experience. Visitors worked on their music patterns in pairs or groups; none collaborated with visitors outside their social group.
- ◆ Most often, adults and children created a music pattern together; typically, children initiated the activity but parents guided the music-making process.
- ◆ Many visitors of all ages displayed counting behaviors and several visitors—primarily adults—explicitly identified their creations as patterns.
- ◆ Some visitors used problem-solving language as they created their music patterns and some used comparisons or comparative language as they played their music pattern creations.

RESTORE THE POWER EXHIBIT

- ◆ Restore the Power attracted visitors of all ages; adults as well as children initiated exhibit usage. Most visitors of all ages who approached the exhibit tried the activity and slightly more than one-half of visitors who tried the activity successfully completed it.
- ◆ Using the Restore the Power exhibit was most often a shared or collaborative experience. Visitors worked in pairs or groups; none collaborated with visitors outside their social group.
- ◆ Among visit groups working together, an adult typically led the activity and/or explained its significance to other group members, including children and/or other adults.
- ◆ Overwhelmingly, adults used general coaching or instructional language to introduce and/or explain the activity. Few, if any, children verbally led the activity.
- ◆ It was most common for adult visitors to identify specific fractions or, less frequently, the concept of fractions in general, particularly when providing instructions to children or other adults.
- ◆ Some visitors used problem-solving language and some also demonstrated counting behaviors, adding up different fractions or counting aloud the number of completed rods.

INTRODUCTION

This report presents the findings from a summative evaluation of the National Science Foundation-funded traveling exhibition *Cyberchase: The Chase Is On!* conducted by Randi Korn & Associates, Inc. (RK&A), for the Children’s Museum of Houston (CMH) in Houston, Texas.

Data collection took place at the Children’s Museum of Houston in Houston, Texas during April 2007 and at the New York Hall of Science in Queens, New York during November and December 2007. The evaluation documents the exhibition’s impact and effectiveness by examining visitors’:

- ◆ Use of the exhibits (exhibits at which they stopped; time spent at individual exhibits and in the exhibition; whether groups used exhibits together; and whether groups discussed exhibit content);
- ◆ Opinions of individual exhibits and the exhibition as a whole;
- ◆ Differences in target audiences’ exhibition experiences;
- ◆ Understanding of and meaning constructed from their exhibition experiences, specifically which of the key content messages (see *Cyberchase: The Chase Is On!* Concept Overview in Appendix G) visitors took away from their experience;
- ◆ Level of engagement, group dynamics, and conversational trends fostered by select exhibits intended to communicate mathematical concepts.

METHODOLOGY

RK&A used three data collection strategies to assess visitors’ experiences in the exhibition: timing and tracking observations, cued exit interviews, and stationed observations (Houston only).

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 5 to 10 years old were eligible to be unobtrusively observed in the exhibition. For each location (i.e., Houston and New York), the evaluator selected visitors to observe using a continuous random sampling method. In accordance with this method, the observer stationed herself at the gallery’s entrance(s), and observed the first eligible visitor to enter, following the selected visitor through the room, recording the exhibits used, noting select behaviors, and logging total time spent in the gallery (see Appendix A for the observation forms). When the visitor completed his or her visit, the observer returned to the entrance to await the next eligible visitor to enter the gallery.

In addition to recording stops made and time spent at each exhibit, the data collector also noted specific behaviors listed on the observation form including misusing an exhibit (using an exhibit in ways developers did not intend). Appendix B provides definitions of misuse and broken exhibits.

EXIT 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. Upon exiting the exhibition at each site, visitors 6 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 post-visit (see Appendix C for the exit interview guides). The interview guide was intentionally open-ended to allow interviewees to discuss what they felt was meaningful. All adult interviews were audio-recorded with participants' permission and transcribed to facilitate analysis.

STATIONED OBSERVATIONS

To provide a more detailed analysis of experiences at a specific activity, RK&A conducted stationed observations at two interactive exhibits in Houston: Playing with Patterns and Restore the Power. During stationed observations, the evaluator watched as visitors used the activity, writing a detailed description (called "thick description" in the anthropology field) about what visitors did, how they interacted with other visitors, and, when possible, recording dialogue. In addition to exhibited behaviors, the observer also noted the approximate ages and genders of observed visitors (see Appendix D for station observation forms). The evaluator unobtrusively watched visitors in each exhibit area for two hours.

DATA ANALYSIS

QUANTITATIVE ANALYSIS

The observation data were analyzed using SPSS 12.0.1, a statistical package for personal computers. Analyses include both 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 E*.

Frequency distributions were calculated for all categorical variables (such as "age", or whether or not a visitor was "coached by an adult"). To examine the relationship between two categorical variables (for instance, "coached by an adult" and "age"), 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")[†]. To test differences in the medians of

* 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.

[†] 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.

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 “site”).

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.

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, the interviewee’s status (adult or child), age, and where s/he was interviewed 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 FOUR MAIN SECTIONS:

1. Timing and Tracking Observations
2. Adult Exit Interviews
3. Child Exit Interviews
4. Stationed Observations

PRINCIPAL FINDINGS: TIMING & TRACKING OBSERVATIONS

Data were collected at the Children’s Museum of Houston (CMH) in Houston, Texas and the New York Hall of Science (NYHS) in Queens, New York. The evaluators observed a total of 200 drop-in visitors between the ages of 5 and 10 years old (100 at CMH and 100 at NYHS).

Data from both sites were combined and are presented as one data set unless the differences between sites were statistically significant. In those cases, data from each site are also presented.

DATA COLLECTION CONDITIONS

At CMH, observers timed and tracked visitors in April 2007. At NYHS, observations were collected during November/December 2007. About two-thirds of observations took place on weekend days (70 percent) and the remaining one-third took place on weekdays (31 percent) (see Table 1, next page). Slightly more observations were collected in the afternoon (58 percent) than in the morning (42 percent). Thirty-nine percent of visitors experienced a low level of crowding, 33 percent experienced a moderate level, and 29 percent experienced a high level.*

Data collectors also noted which entrance visitors used and whether the character Digit appeared during the observation. At CMH, one-half of visitors used the Inspirations Gallery entrance and the remaining one-half of visitors used the Farm to Market entrance. At NYH, the majority of visitors (92 percent) used the Main entrance and the remaining visitors used the Main exit (8 percent). The character Digit appeared during 4 percent of the observations.

* A low level of crowding means that only a few visitors are present in the exhibition, a moderate level of crowding means there is a steady, comfortable flow of visitors through the exhibition space, and a high level of crowding means that the exhibition has met or exceeded its capacity so that visitors have difficulty moving freely.

TABLE I
DATA COLLECTION CONDITIONS

CONDITIONS (n = 200)	TOTAL %
Day of the week	
Weekend day	69.5
Weekday	30.5
Time of day	
PM	58.1
AM	41.9
Level of Crowding	
Low	38.5
Moderate	33.0
High	28.5
Entrance Used (CMH)	
Inspirations Gallery	50.0
Farm to Market	50.0
Entrance Used (NYH)	
Main Entrance	92.0
Main Exit	8.0
Character Appearance	
Digit NOT Present	96.4
Digit Present	3.6

VISITOR DESCRIPTIONS

Data collectors recorded gender and approximate age of each observed child. As shown in Table 2, the total sample of visitors observed included slightly more males than females (51 percent and 49 percent, respectively). Likewise, slightly more visitors were between the ages of 5 to 7 years old (51 percent) than between the ages of 8 to 10 years old (49 percent).

TABLE 2

VISITOR DEMOGRAPHICS

CHARACTERISTIC	TOTAL %
Gender	(n = 200)
Male	51.0
Female	49.0
Approximate age group	(n = 200)
5 to 7 years old	51.0
8 to 10 years old	49.0

Observers noted which visitors spoke Spanish as opposed to English or another language. Nine percent of visitors were observed speaking Spanish, while the majority of remaining visitors spoke English.* (see Table 3).

TABLE 3

LANGUAGE USED IN EXHIBITION

LANGUAGE (n = 200)	TOTAL %
No Spanish spoken	91.4
Spanish spoken	8.6

* These figures are representative of the total number of visitors tracked through the exhibition and not of the total Spanish-speaking audience.

In addition to noting the demographics of the observed child, data collectors also recorded the number of adults and children who accompanied him/her and the approximate ages of the children. On average, each observed child was accompanied by one other child and one adult (See Table 4). More than one-half were accompanied by children ages 7 and under (58 percent), while about one-fifth visited with children ages 8 to 12 years old (22 percent) (see Table 5).

TABLE 4

GROUP CHARACTERISTICS

CHARACTERISTIC	MEAN	MEDIAN	±
Group Composition (n = 200)			
Number of children	.9	1.0	.9
Number of adults	1.3	1.0	.7

TABLE 5

APPROXIMATE AGE OF OTHER CHILDREN IN GROUP

CHARACTERISTIC	TOTAL %
Approximate age	(n = 200)
4 and younger	33.5
5 to 7	24.0
8 to 10	10.5
11 to 12	11.0
13 to 17	2.0

OVERALL VISITATION PATTERNS

TOTAL TIME SPENT IN THE EXHIBITION

At both sites, visitors spent a median time of 7 minutes in *Cyberchase: The Chase Is On!* The shortest time a visitor spent in the exhibition was 23 seconds and the longest time was over 1 hour, observed at NYHS (see Table 6).

TABLE 6

TOTAL TIME SPENT IN *CYBERCHASE: THE CHASE IS ON!*

SITE (n = 200)	MEDIAN	MINIMUM	MAXIMUM	MEAN	±
CMH and NYHS	7 min., 15 sec.	23 sec.	1 hr., 7 min., 27 sec.	10 min., 57 sec.	11 min., 53 sec.

TOTAL NUMBER OF EXHIBITS AT WHICH VISITORS STOPPED

Cyberchase: The Chase Is On! included 24 exhibits at which visitors could stop. 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.

At both sites, the median number of exhibits visitors stopped at was five. The minimum number of exhibits visitors stopped at was one, observed at both sites; the maximum number of exhibits stopped at was 17, observed at CMH (see Table 7).

TABLE 7

TOTAL NUMBER OF EXHIBITS STOPPED AT IN *CYBERCHASE: THE CHASE IS ON!*

SITE (<i>n</i> = 200)	MEDIAN	MINIMUM	MAXIMUM	MEAN	±
CMH and NYHS	5.0	1.0	17.0	5.8	3.6

Further analysis shows that younger visitors ages 5 to 7 years old stopped at more exhibits (median = 6 exhibits) than did older visitors ages 8 to 10 years old (median = 4 exhibits) (see Table 7a).

TABLE 7A

DIFFERENCES IN TOTAL NUMBER OF EXHIBITS STOPPED AT BY AGE

APPROXIMATE AGE OF CHILD	<i>n</i>	MEDIAN
5 to 7 years old	102	6.0
8 to 10 years old	98	4.0

Mann-Whitney U = 3835.0; *p* = 0.004

VISITATION TO INDIVIDUAL EXHIBITS

TIME SPENT AT EACH EXHIBIT

See Table 8 (for a list of the median times for all exhibits at which visitors spent time. Visitors spent the most time at Restore the Power (median = 1 minute, 56 seconds), followed by Jimayan Mystery (median = 1 minute, 55 seconds), Aim is the Game (median = 1 minute, 50 seconds), and Playing with Patterns (median = 1 minute, 45 seconds). Visitors spent the least time at the Introductory *Cyberchase* video (median time = 15 seconds), Aim is the Game video (median time = 13 seconds), Wig Gels video (median time = 13 seconds), and R-Fair City video (median time = 10 seconds).

TABLE 8

TIME SPENT AT INDIVIDUAL EXHIBITS

EXHIBIT COMPONENT (<i>n</i> = 200)	% VISITORS WHO STOPPED	MEDIAN TIME (SEC.)
Restore the Power	20.0	116
Jimayan Mystery	21.5	115
Aim is the Game	37.5	110
Playing with Patterns	36.0	105
Power-up Station: Bicycle	31.5	72
Jimayan Mystery video	1.5	67
Control Central: Computer Game Stations	35.5	62
Hacker's Closet	19.0	60.5
R-Fair City	33.0	56
Kahuna-Huna Race-a-Runa	31.5	55
Power-up Station: Hand-crank	31.0	49
Poddle Family Patterns	22.5	43
Poddleville Line-up Station	27.5	42
Who's Who in Poddleville	30.5	38
Magnetite Rocket	41.0	35
Find Hacker Game	15.5	31
Rebuild Eureka	24.0	30
Dragon Dilemma	23.5	27
Control Central Main Monitor	23.5	26
Wig Gels	15.0	20
Introductory <i>Cyberchase</i> video	18.5	15
Aim is the Game video	11.5	13
Wig Gels video	11.0	12.5
R-Fair City video	10.5	10

STOPS MADE AT EACH EXHIBIT

Visitors could stop at 24 exhibits (see Table 9). The three exhibits at which the most visitors stopped were the Magnetite Rocket (41 percent), Aim is the Game (38 percent) and Playing with Patterns (36 percent). The exhibits at which the fewest visitors stopped were Aim is the Game video (12 percent), Wig Gels video (11 percent), and R-Fair City video (11 percent), and Jimayan Mystery video (2 percent).

TABLE 9
INDIVIDUAL EXHIBITS AT WHICH VISITORS STOPPED

EXHIBIT COMPONENT (n = 200)	% VISITORS WHO STOPPED
Magnetite Rocket	41.0
Aim is the Game	37.5
Playing with Patterns	36.0
Control Central: Computer Game Stations	35.5
R-Fair City	33.0
Power-up Station: Bicycle	31.5
Kahuna-Huna Race-a-Runa	31.5
Power-up Station: Hand-crank	31.0
Who's Who in Poddleville	30.5
Poddleville Line-up Station	27.5
Rebuild Eureka	24.0
Dragon Dilemma	23.5
Control Central Main Monitor	23.5
Poddle Family Patterns	22.5
Jimayan Mystery	21.5
Restore the Power	20.0
Hacker's Closet	19.0
Introductory <i>Cyberchase</i> video	18.5
Find Hacker Game	15.5
Wig Gels	15.0
Aim is the Game video	11.5
Wig Gels video	11.0
R-Fair City video	10.5
Jimayan Mystery video	1.5

VISITOR BEHAVIORS

Observers noted a total of sixteen different visitor behaviors depending on the exhibit. The total incidences of the four most commonly recorded behaviors are presented in Table 10. Detailed information about behaviors at individual exhibits is provided in Appendix F.

SUMMARY OF BEHAVIORS

Slightly less than two-thirds of all visitors were coached by an adult (61 percent), 46 percent of visitors interacted verbally with others, and 39 percent of visitors misused an exhibit (see Table 10). Only 3 percent of visitors observed listened to an exhibit component in Spanish.

TABLE 10
PERCENTAGE OF VISITORS WHO EXHIBITED BEHAVIORS IN
CYBERCHASE: THE CHASE IS ON!

BEHAVIOR (<i>n</i> = 200)	% TOTAL VISITORS
Coached by an adult	61.0
Other verbal interaction	46.0
Exhibit Misuse	39.0
Listened in Spanish	2.5

Further analysis revealed that significant differences occurred in certain behaviors by age. In addition, children ages 5 to 7 years old were more likely to be coached by an adult than were children ages 8 to 10 years old (see Table 10a**B**).

TABLE 10aB
DIFFERENCES IN COACHING BY AGE

BEHAVIOR	AGE OF CHILD	
	5 TO 7 YEARS OLD (<i>n</i> = 102)	8 TO 10 YEARS OLD (<i>n</i> = 98)
	%	%
Coached by an adult	72.5	49.0

$\chi^2 = 11.671$; $df = 1$; $p = .001$

PRINCIPAL FINDINGS: ADULT EXIT INTERVIEWS

BACKGROUND INFORMATION

RK&A conducted interviews with a random sample of visitors after they exited the *Cyberchase: The Chase Is On!* exhibition at CMH in April 2007 and NYHS in November/December 2007. Interviews were conducted with 56 adults visiting with at least one child between 5 and 10 years old. Approximately two-thirds of interviewees were female ($n = 37$) and about one-quarter of interviewees were bilingual or Spanish-speaking ($n = 15$). Adults ranged in age from 22 to 62 years old, with a median age of 40 years old. Children accompanying adults ranged in age from about 1 to 13 years old, with a median age of 6 years old. Of visitors approached and asked to participate in the study, 19 declined to do so, making the refusal rate 25 percent.

The two sets of interviews (CMH and NYHS) were analyzed separately, but no notable differences were found between the two groups. Likewise, there were no notable differences between Spanish- and non-Spanish-speaking adults. Thus, the data are presented as one group.

OVERALL VISITOR OPINIONS

Interviewees were asked their thoughts of the exhibition as a parent visiting with a child. Most interviewees said something positive about the exhibition using words like “entertaining” or “engaging” and about one-half of adults praised its educational or interactive nature. About one-fifth of interviewees said the exhibition was not entirely age-appropriate for their child or that they were disappointed by the exhibition set-up (i.e., individual exhibits were broken or too close together).

FAVORITE ASPECT OF EXHIBITION

Adults were asked to name their favorite aspect of the exhibition in addition to what they thought their child enjoyed most.

ADULTS' FAVORITE ASPECTS

Slightly more than one-third of interviewees said they most enjoyed the exhibition's ability to engage their child or its kid-friendly design (see the first two quotations below). Approximately one-third of adults said they most enjoyed the exhibition's interactive or educational aspects, often citing both together (see the third and fourth quotations). Another one-third of interviewees named a particular exhibit as their favorite with no one exhibit more popular than another, and cited the interactive or educational aspects of the exhibit as the reason they liked it most. The remaining responses were idiosyncratic.

[I liked] the lights and the presentation [the exhibit] makes. For children, they like the excitement and to see the lights go on like that, it's exciting for them and I think it [catches] their eye. [Female, 58, CMH]

(Overall, what did you like best about the exhibition?) I think the simplicity . . . that even though the concepts aren't so simple, the ways for them to use [the concepts] were simple. [The kids] could just enjoy using it. [Female, 43, NYHS]

(Overall, what did you like best about the exhibition?) All the stations that are hands-on, but also help them think. I think kids in the process of growing up need to know where they are going, and what actions are going to bring about certain results. [Male, 32, CMH]

I guess I liked that it's very interactive and for the kids who have seen the show a lot, it's their [opportunity] to utilize the principles they have learned on the show. [Female, 43, NYHS]

CHILDREN'S FAVORITE ASPECTS

Approximately one-third of interviewees named the Power-up Station Bicycle or Hand crank and Restore the Power as their child's favorite exhibit because their child was engaged by their interactive nature (see the first two quotations below) or because they thought their child felt successful after using the exhibit (see the third quotation). Most of the remaining interviewees named a variety of other exhibits with no one exhibit more popular than another and a couple of parents said they did not know what their child enjoyed the most.

(From watching and interacting with your child, which activity would you say they most enjoyed?) The one with the power, with the batteries . . . they get to use their hands to try different sizes. [Female, 43, CMH]

[My kids] liked the ones that are active, like the bicycle and the pumping thing. They liked the interaction part of it, definitely. [Female, 35, NYHS]

(From watching and interacting with your child, which activity would you say they most enjoyed?) The bicycle and the pump one . . . because she could move and do something and saw results. [Female, 53, CMH]

When asked more specifically about their child's favorite exhibit, slightly less than one-half of interviewees said their child enjoyed a particular exhibit because it was interactive or educational, often mentioning both qualities at the same time (see the first two quotations below). One-third of interviewees said their child most enjoyed an activity because they achieved success. More specifically, adults said their child was successful either because the activity was familiar or because they discovered how to "win" (see the third and fourth quotations). A few interviewees said the activity their child enjoyed most was "fun" or "engaging," but did not elaborate on the reason. The remaining responses were idiosyncratic.

I guess [she liked] building the little things from those different shapes of plastic. She likes building things and creating different things. [Male, 45, NYHS]

(From watching and interacting with your child, which activity would you say they most enjoyed?) I guess that one activity with the numbers, those ancient numbers. (Why do you think that activity worked so well for your child?) Because they are playing with numbers and figuring out how people used numbers in the past in a different way. They knew how to do it and were well entertained, and enjoyed themselves a lot. [Male, 28, CMH]

The [part he liked best] was the electricity one where you can stack them up . . . because he knew how to do it and didn't have to read the directions. [Female, 35, CMH]

(From watching and interacting with your child, which activity would you say they most enjoyed?) The one with the dragon . . . they [were] able to use it to figure out what to do. At first, it was just a game, and then after awhile you could see that they [were] actually trying to figure out how they [were] going to win. [Female, 38, NYHS]

LEAST FAVORITE ASPECT OF EXHIBITION

Adults were asked to name their least favorite aspect of the exhibition in addition to what they thought their child enjoyed least.

ADULTS' LEAST FAVORITE ASPECTS

Slightly more than one-third of adults said there was nothing they liked least about the exhibition. One-third of interviewees said their least favorite aspect was the exhibition's apparent lack of proper maintenance or set-up (i.e., broken exhibits or crowded exhibition space) (see the first two quotations below). A few interviewees liked least that certain exhibits were not age-appropriate for their children (see the third quotation) and a couple of interviewees were unsure what they liked least.

(Overall, what did you like least?) Probably just the chaos, it's really close together. There's not enough room to separate activity from activity. [Female, 40, CMH]

Some of the exhibits have clearly been used a lot and they are missing pieces. The Poddleville [exhibit] was missing some pieces and, particularly for kids this age, that is very frustrating. [Female, 43, NYHS]

I think [the exhibition] was aimed for slightly older kids . . . that was the only negative thing. [Male, 39, CMH with Female, 7 and Male, 2]

CHILDREN'S LEAST FAVORITE ASPECTS

Approximately one-half of adults named a specific exhibit as their child's least favorite. No one exhibit was less popular than another. One-quarter of interviewees said that no exhibit was their child's least favorite and the remaining interviewees were unsure what their child liked least.

When probed further about their child's least favorite exhibit, one-third of interviewees said the exhibit was not "fun" or did not engage their child (see the first quotation, next page). One-quarter of interviewees said an exhibit was their least favorite because it was not age-appropriate (see the second quotation). Several interviewees said the exhibit set-up (i.e., pieces missing or physically difficult to use) was the reason their child liked a particular exhibit least (see the third quotation). A couple of interviewees were unsure why their child liked an exhibit least.

(Which activity, if any, did your child skip or seem less interested in?) The one that you lift up and down and [transfer] energy to [a] motherboard . . . [there were] not enough lights and colors to get her over there. [Female, 30, CMH]

[My older son] did not care about the Mayan numbers although my younger son did. The 7 year old enjoyed that, but the 9 year old didn't care for that. I think he [the 9 year old] just saw that it was counting. It was maybe just too basic. It didn't really challenge [him]. [Female, 43, NYHS]

(Which activity, if any, did your child skip or seem less interested in?) The one in the back because there were pieces missing . . . where you had little pods from Poddleville and you had to . . . fill in the pattern, but you couldn't because there weren't any pieces. [Female, 42, NYHS]

BRAND IMPACT

Interviewees were asked whether the *Cyberchase* brand impacted their overall opinion of the exhibition. Two-thirds of interviewees said the *Cyberchase* brand positively affected their opinion of the exhibition. Most said their child enjoyed the exhibition more because it was *Cyberchase* and several said they came to

the museum specifically to see the exhibition (see the first two quotations below). Most of the remaining interviewees were unaware of the *Cyberchase* brand or it did not have an effect on their opinion of the exhibition. A couple of interviewees said their knowledge of the *Cyberchase* brand negatively impacted their opinion of the exhibition (see the third quotation below).

(How much, if at all, did the *Cyberchase* brand impact your opinion of the exhibition?) Personally, a lot. It impacted the way the kids interact. When she saw it she said ‘Look Mommy, *Cyberchase*’ because she watches it on TV. [Female, 42, CMH]

(How much, if at all, did the *Cyberchase* brand impact your opinion of the exhibition?) Yes, I mean that’s why we came. My children had seen the commercials for a long time and specifically wanted to come to [NYHS] in order to see the *Cyberchase* [exhibition]. [Female, 43, NYHS]

[My son] loves *Cyberchase*, he thought it would be really cool. Again, I expected more because of the *Cyberchase* [brand] . . . I expected more of the *Cyberchase* part of it. You know, I think it’s almost a little low tech for *Cyberchase*. [Female, 40-50, NYHS]

CONVEYING THE CONTENT

EXHIBIT MESSAGES

Interviewees were asked what they thought the exhibition was trying to show or tell people. One-half of interviewees spoke about the exhibition’s main idea in terms of math. Of those who discussed math, one-half said the exhibition was trying to teach math or science concepts in a general way (see the first quotation, next page), and the other one-half said the exhibition was specifically trying to show how math can be used in everyday life or that math can be fun (see the second and third quotations). Approximately one-third of adults said the exhibition was meant to be educational in some way, but did not specifically mention math (see the fourth quotation). A couple of interviewees were unsure what the exhibition was trying to show people. The remaining responses were idiosyncratic.

(Just off the top of your head, what do you think this *Cyberchase* exhibition is trying to show or tell people?) To incorporate, obviously, math and science for kids. [Female, 42, NYHS]

(Just off the top of your head, what do you think this *Cyberchase* exhibition is trying to show or tell people?) I guess different ways you can use numbers to create things in [kids’] everyday lives. [Female, 43, NYHS]

I think [the exhibition] is just trying to show that science and math [are] fun. [Female, 40, CMH]

[The exhibition] is meant for kids to become aware of what they don’t know. [Female, 55, CMH]

EVERYDAY MATH AND MATH SKILLS USED

When probed specifically about math, most interviewees named at least one thing in the exhibition relating to everyday math used at home, at work, or in school in addition to at least one general math skill their child used. More specifically, about one-third of interviewees named Restore the Power or Poddle Family Patterns as an exhibit relating to everyday math because their child uses fractions and patterns at home or in their schoolwork (see the quotations below). Most of the remaining interviewees named a variety of other exhibits as relating to everyday math or as a place their children

used math skills. No one exhibit was named more often than another in either respect. A few interviewees were unsure whether their child used math in the exhibition.

(Based on your experience with your child in this exhibition, please describe for me an activity that reminded you of something math-related you or your child does at home, work, or school.) When we assembled the connectors for the motherboard . . . quarters and thirds . . . that definitely was it . . . (Can you tell me more about that?) I guess it's basic division and fractions . . . in second grade, they do stuff like that. [Male, 42, CMH]

Well, the thing [with] the fractional parts adding up to a whole, we've done stuff like that at home. [Female, 39, NYHS]

There was a whole section over there on patterns and [asking] 'what is the next sequence in the pattern?' [She] does that when she brings home her sewing. [Female, 43, CMH]

USE OF BILINGUAL LABELS

Nearly all interviewees said they noticed the bilingual labels as they were going through the exhibition. The majority of interviewees spoke positively about the labels, saying they liked that they helped Spanish-speaking individuals use the exhibition or helped non-Spanish speaking children learn about the language (see the first two quotations below). A few interviewees said the labels made it difficult to use the exhibit or were unnecessary in an American museum (see the third quotation). A couple of interviewees were unsure how they felt about the labels.

(What do you think about the use of bilingual labels in an exhibition like this?) It's really good to [have] the two languages for the parents that don't speak English . . . also, the kids will learn both languages. It's really good. [Spanish-speaking male, 28, CMH]

I think it's great. It makes [the exhibition] approachable for more people. [Male, 43, NYHS]

I think [the bilingual labels] are great educationally, but I didn't like that [exhibit components] were separate. I think because it limits how many [exhibit components] are in a particular language. [Female, 40's, NYHS]

PRINCIPAL FINDINGS: CHILD EXIT INTERVIEWS

BACKGROUND INFORMATION

RK&A conducted in-depth interviews with children who visited *Cyberchase: The Chase Is On!* after they exited the exhibition at CMH in April 2007 and NYHS in December 2007. Interviews were conducted with 63 children—30 at CMH and 33 at NYHS. Of these interviewees, 15 were bilingual or Spanish-speaking and 48 were non-Spanish speaking. Slightly more than one-half of interviewees were female ($n = 33$). Interviewees ranged in age from 5 years to 10 years old, with a median age of 7 years.

The two sets of interviews (CMH and NYHS) were analyzed separately, but no notable differences were found between the two groups. Likewise, there were no notable differences between Spanish- and non-Spanish-speaking children. Thus, the data are presented as one group.

OVERALL VISITOR OPINIONS

FAVORITE ASPECT OF EXHIBITION

Children were asked to identify what they liked best about their *Cyberchase* experience and why. Approximately one-third of children said they liked Aim is the Game or the Power-up Station Bicycle the best, followed in popularity by R-Fair City and Dragon Dilemma (about one-fifth). The remaining interviewees named a variety of other exhibits. No one exhibit was more popular than another.

Children chose their favorite exhibit for different reasons. Some enjoyed the hands-on, interactive nature of an exhibit and liked that they could press buttons, pull a lever, ride a bicycle or play with blocks. Several children said they liked an exhibit because it allowed them to problem-solve or to succeed (i.e., “winning”). Of those children who chose Playing with Patterns, all said it was because they enjoyed hearing music. A few interviewees chose their favorite exhibit because it was familiar in some way or because they could play it with a friend or family member. Finally, a couple of children mentioned math as the reason they liked an exhibit.

UNDERSTANDING OF EXHIBITION CONTENT

MATH LEARNED IN EXHIBITION

When asked specifically about math, nearly one-half of interviewees said they did something math related as part of their *Cyberchase* experience—some of it new and some of it previous knowledge. Interviewees said they learned about numbers, counting, addition, subtraction, weights, and patterns. Fractions, graphs, angles, combinations, or sequencing were also mentioned at least once by an interviewee. The remaining interviewees said they did not learn anything about math. However, to probe children further, the interviewer displayed photographs of several exhibit areas and asked children to talk about any math they had done. Of those interviewees who said they did not learn anything new or did not remember any math, most described something math-related during this additional probing. For example, one child (male, 8 years, NYHS) said when playing Who’s Who in Poddleville, he had to “divide all the sacs” to get the same weight on either side of the scale. In general, when interviewers probed children further while showing them photographs of the exhibits, the amount of math they mentioned varied among exhibit areas. The majority of children mentioned doing math in the Poddleville exhibit, including weights, patterns, and shapes. In the remaining exhibit areas, children mentioned using a variety of math with no exhibit discussed more often than another.

PRINCIPAL FINDINGS: STATIONED OBSERVATIONS

EXHIBITS REMINISCENT OF EVERYDAY MATH

Children were asked to describe an activity from the exhibition that reminded them of the math they do at home or school, and two-thirds were able to do so. Children talked about a variety of exhibits and math, with no one exhibit or concept more popular than another. A few children mentioned balancing weights in *Who's Who in Poddleville* and said the math was familiar because they use scales at home or in the school lab. A few other children said that shapes, fractions, adding/subtracting, probability, or counting reminded them of the math they do at school or as part of their homework. One-fifth of children mentioned an exhibit that reminded them of something other than math, like riding their bike or listening to music. The remaining children were unsure if there was something math-related they had done before.

CHANGES IN ATTITUDES TOWARD MATH

Interviewees were asked to complete two sentences: “Before seeing this exhibition, math made me feel: . . .” and “After seeing this exhibition, math makes me feel: . . .” -The majority of children finished the first sentence with positive adjectives like “happy,” “excited,” “good,” or “fun.” A smaller number used negative words like “bored” or “mad.” A couple of interviewees completed the sentence neutrally, saying math made them feel “ok,” or did not know how math made them feel.

Children varied in how they completed the second sentence. Most children had a positive shift in their feelings about math after seeing the exhibition. Of these children, about one-third felt the exhibition made math “fun” or “exciting” by having games for them to play, one-third felt like they learned math or felt better prepared for math, and one-fifth had a general positive shift (“happy” to “happier” or “good” to “great”). Most of the remaining one-quarter of children did not change their feelings about math, completing the second sentence in much the same way as the first.

USE OF BILINGUAL LABELS

Approximately two-thirds of all interviewees—at CMH and NYHS—noticed the bilingual labels. Of these interviewees, about one-half said they were a good idea, either because they helped Spanish-speaking visitors use the exhibit or because it was “cool” to see Spanish labels. About one-quarter of those who noticed the labels did not use them or had neutral feelings. A few children said they did not like the labels because they could not understand them or did not know why they did not like them.

BACKGROUND INFORMATION

Interactive exhibits throughout *Cyberchase: The Chase Is On!* were designed to appeal to children of a broad age range, from 5 to 12 years old, with an emphasis on children 7 years and older, and were intended to promote children’s development of mathematical strategies and their confidence in using these strategies in daily life (see Appendix G for the *Cyberchase: The Chase Is On!* Concept Overview). To provide a detailed account of how visitors used the exhibits and to determine whether their usage reflected mathematics-related learning, RK&A observed visitors at two exhibits identified by museum staff as among the most frequently used: *Playing with Patterns* and *Restore the Power*.

The evaluator stationed herself at each exhibit and observed visitors as they used the activity. She noted visitors’ ages, genders, and familial relationships (if she could determine them) and wrote a detailed description of their actions and conversations. The evaluation goals for the stationed observations were to:

- ◆ Record the level of visitor engagement with each exhibit;

- ◆ Document group dynamics fostered by each exhibit; and,
- ◆ Capture conversational trends and topics, particularly mathematics-related language, inspired by each exhibit.

RK&A observed a total of 178 visitors at the two exhibits over four hours on a Saturday afternoon at CMH.

PLAYING WITH PATTERNS EXHIBIT

PLAYING WITH PATTERNS EXHIBIT DESCRIPTION*

The topic of this exhibit is “Pattern Sequences.” Visitors create musical patterns, or recreate popular Latino or English songs, by placing wooden balls on a horizontal gridded platform that corresponds to a full scale. As they turn a crank, the platform “dumps” the balls onto xylophone blocks.

VISITOR DEMOGRAPHICS

A total of 93 visitors approached and/or used Playing with Patterns during a two-hour observation. Over one-half of observed visitors were children younger than 14 and almost one-half were adults (54 percent and 46 percent, respectively). Fifty-one percent were male and 49 percent were female.

Over one-third of children ranged in age from 5 to 7 years old (38 percent), followed by children ages 4 years old and younger (26 percent), children ages 8 to 10 years old (24 percent), and children ages 11 to 13 years old (12 percent). About two-thirds of adults were between 25 and 54 years old (67 percent), while adults age 55 years and older made up 21 percent of observed adult visitors. Teenagers and young adults age 14 to 24 years old made up the remaining 12 percent of adult visitors.

Of 34 visitor groups, the evaluator heard visitors in three groups speaking Spanish and visitors in another group speaking a language other than English or Spanish.

OVERALL RESPONSE

Children were drawn to the Playing with Patterns exhibit, typically calling over adults and/or other children in their visit groups to join them. Whether alone or within groups, children were the primary users of Playing with Patterns; parents and other adults only used the exhibit with children. Children of all ages tended to try the activity without viewing instructional labels or the music pattern instructional cards, whereas most adults did the opposite and many tried to encourage children’s label/card usage. Most visitors—children and adults alike—successfully created and played their own music patterns without attempting to use the music pattern instructional cards. Among the six visit groups who used the music pattern instructional cards to recreate and play popular songs, all but one group were led by adults and most successfully completed the activity (e.g., playing “Happy Birthday”).

HOW VISITORS USED THE PLAYING WITH PATTERNS EXHIBIT

Upon approaching the exhibit, nearly all children immediately began either: 1) tossing or placing balls onto the player’s platform without purpose or turning the crank; or 2) turning the crank in the wrong direction or when the player had no balls inside. Next, most children ages 8 years and older stopped using the exhibit, often at an adult’s prompting, to read or listen to instructions and then followed the appropriate steps (i.e., placing balls on the platform purposefully and then turning the crank correctly) to complete the activity. In contrast, most children ages 7 years and younger continued experimenting until they were physically led by an adult or older child through the activity’s steps. Nearly all adults

* Excerpted from *Cyberchase: The Chase Is On!* Concept Overview, Children’s Museum of Houston and Argyle Design, May 1, 2006.

began by watching their children, and waited to join them until they appeared to need or requested assistance. Additionally, adults frequently viewed or read the instructions aloud prior to and/or during exhibit use.

At some point while they were using the exhibit, nearly all visitors purposefully placed balls inside the player—creating their own music patterns or following the instructional cards’ patterns—although a few children-only groups continued randomly tossing or placing balls inside until all were used up. Some visitors experimented by arranging the balls in more than one pattern on the player’s platform before turning the crank and listening to the “music.” Although the majority of visitors completed the activity only once, some visit groups repeated the process one or more times.

GROUP DYNAMICS

Creating a music pattern was always a shared or collaborative experience. Visitors worked on their music patterns in pairs or groups; none collaborated with visitors outside their familiar social group. Most often, adults and children created a music pattern together; typically, children initiated the activity but parents guided the music-making process, often instructing children ages 8 years and older verbally (e.g., “Wait! What does it say you should be trying to do here?”), and assisting children ages 7 years and younger physically (e.g., helping to turn the crank in the correct direction). Parents frequently encouraged children of all ages to purposefully place balls onto the player’s platform and to listen to the musical outcome when turning the crank. Although a few groups of children ages 8 years and older completed the activity without adult assistance, children were more likely to successfully complete the tasks of creating and playing a music pattern when parents or other adults helped.

MATHEMATICS-RELATED CONVERSATIONAL TRENDS

The evaluator identified a variety of conversational trends among visitors using the Playing with Patterns exhibit, including a few related to learning mathematics (see Table 11). It was most common for visitors, primarily adults, to use coaching or instructional language to introduce and/or explain the activity. Similarly, adults used such language to encourage or praise children’s exhibit usage (e.g., “Good job! That’s it, you did it!”). Throughout the activity, adults and children frequently used music-related or descriptive language when collaborating with other visitors to create music patterns (e.g., “If you just throw the balls in, it won’t make good music” or “It sounded like this: boo-bee-do, boo-bee-do.”). With regard to mathematics-related learning, many visitors of all ages displayed counting behaviors, that is, they counted aloud as they purposefully placed balls inside the player (e.g., “How many balls do you want to put in that row, four or five?”). Several visitors, primarily adults, explicitly identified their creations as patterns (e.g., “Look at the pattern, see how it starts at one then five and then repeats?”).

Some visitors used problem-solving language as they created their music patterns. For example, adults sometimes encouraged children to problem-solve (e.g., “What’s the problem? Try turning the crank the other way.”), while children sometimes expressed pride when they successfully solved a problem (e.g., “I figured it out! The trick is to play it at the same speed.”). Some visitors used comparisons or comparative language as they played their music pattern creations. For example, a few visitors who used instructional card patterns compared their musical outcome to the tune they were trying to create (e.g., “That didn’t sound like ‘Mary had a little lamb,’ let’s try it again.”). Similarly, a few visitors who created original music patterns also compared their outcomes (e.g., “Did you hear how different that sounded from the first one?”). A few other visitors used language that implied precision, referring to order and/or placement (e.g., “Put the balls exactly where you want them, one at a time.”) and working precisely to place the balls on the player’s platform.

TABLE 11
CONVERSATIONAL TRENDS: PLAYING WITH PATTERNS STATIONED OBSERVATION

CONVERSATIONAL TREND	EXAMPLE
Coaching/Instructional	<ul style="list-style-type: none"> - Now turn the crank slowly and listen. - Good job! That’s it, you did it! - Wait! What does it say you should be trying to do here?
Music-related	<ul style="list-style-type: none"> - If you just throw the balls in, it won’t make good music. - We’re making a song, did you hear how it went up and then down like a scale? - Let’s try to make a tune.
Descriptive	<ul style="list-style-type: none"> - It sounded like this: boo-bee-do, boo-bee-do. - I want to make a big song.
Counting	<ul style="list-style-type: none"> - First we have to put the balls inside, and then we turn the crank. - See how it says, ‘1, 2, 1, 2?’ Find 5 balls--now the next row you need 6 then 5. - How many balls do you want to put in that row, four or five?
Patterns	<ul style="list-style-type: none"> - We’re supposed to be making patterns. - Look at the pattern, see how it starts at 1 then 5 and then repeats? - I don’t want to go, I’m still patterning!
Problem-solving	<ul style="list-style-type: none"> - I figured it out! The trick is to play it at the same speed. - What’s the problem? Try turning the crank the other way.
Comparison	<ul style="list-style-type: none"> - Did you hear how different that sounded from the first one? - That didn’t sound like ‘Mary had a little lamb,’ let’s try it again.
Precision	<ul style="list-style-type: none"> - You have to place the balls inside in a certain order. - Put the balls exactly where you want them, one at a time.

RESTORE THE POWER EXHIBIT

RESTORE THE POWER EXHIBIT DESCRIPTION*

The topic of this exhibit is “Fractions.” In it, Hacker has removed power circuit rods needed to keep Control Central running. To restore the power, visitors reinsert combinations of fractional pieces of rods to fill the empty slots. There are a number of possible solutions. Visitors can place the rods on the equivalence chart to compare fractions before placing them on the board. Visitors will need to find combinations of rods that can fill in whole amounts, either “1” or “2” whole rods wide.

VISITOR DEMOGRAPHICS

A total of 85 visitors approached and/or used Restore the Power during a two-hour observation. Slightly over one-half of observed visitors were adults (ages 14 and older) and almost one-half were children (52 percent and 48 percent, respectively). Fifty-four percent were male and 46 percent were female.

Almost one-half of children ranged in age from 5 to 7 years old (44 percent), followed by children ages 8 to 10 years old (34 percent). Children ages 4 years old and under comprised 20 percent of all children, and children ages 11 to 13 years old made up the remaining 2 percent. Over two-thirds of adults were between the ages of 25 and 54 years old (70 percent), while adults ages 55 years and older made up 20 percent of observed adult visitors. Teenagers and young adults ages 14 to 24 years old made up the remaining 10 percent of adult visitors.

Of 40 visitor groups, the evaluator heard visitors in five groups speaking Spanish and visitors in two other groups speaking a language other than English or Spanish.

OVERALL RESPONSE

Restore the Power attracted visitors of all ages; adults as well as children initiated exhibit usage. Children and adults, working together and independently, were the primary users of the exhibit. While adults most often used the exhibit accompanied by children, a few stayed behind to continue doing the activity after their children had moved on. Additionally, a few adults approached and used the exhibit alone. Most visitors of all ages who approached the exhibit tried the activity, although a few individuals only stopped to look at the exhibit or to watch visitors in other groups using it. Few children demonstrated any use of exhibit signage, whereas the evaluator observed many adults reading aloud or referencing (e.g., pointing at) signage at some point during usage. Slightly more than one-half of visitors who tried the activity successfully completed it (i.e., filling at least one empty slot with rod combinations).

HOW VISITORS USED THE RESTORE THE POWER EXHIBIT

Upon approaching the exhibit, visitors’ initial actions depended on whether the exhibit had been reset (i.e., whether the slots were full of rods or empty). If slots were full or mostly full, visitors most often removed rods from the slots by hand (rather than hitting the reset button) before picking up rods from the bin and attempting to fit them into slots. If slots were empty or mostly empty, visitors immediately began picking up rods from the bin and attempting to fit them into slots. Children under age 8 years most often knelt or stood on top of a stool to use the exhibit, whereas most children ages 8 years and older and adults stood.

* Excerpted from *Cyberbase: The Chase Is On!* Concept Overview, Children’s Museum of Houston and Argyle Design, May 1, 2006.

Children of all ages primarily used a process of trial and error to select rods and fit them into slots, although their experimentation differed by age. For example, children under age 8 years old typically picked up rods at random and tried physically forcing them into slots, resulting in other rods popping off the board. In contrast, children ages 8 and older were more likely to examine the rods and/or slots, often comparing sizes (e.g., holding rods up to empty slot spaces), before attempting to fit rods into slots. Despite their more calculated efforts, older children frequently knocked rods off the board.

Although the evaluator observed a few children ages 8 years and older viewing exhibit signage while using the exhibit during usage, none read aloud from or explicitly demonstrated they were referencing signage. Instead, most children relied upon adults in their visit groups to explain the purpose of the activity and to verbally guide them in selecting and fitting rods into the slots. In contrast, many adults read aloud or referenced signage—typically to lead children and/or other adults in the activity— at some point during exhibit usage.

While most visitors of all ages who approached the exhibit tried the activity, only slightly more than one-half successfully completed it (e.g., filling up at least one empty slot with rod combinations). Most of those who did not successfully complete the activity walked away from the exhibit after picking up and attempting to fit at least one rod into a slot. Among visitors who successfully completed the activity, most filled only one or two empty slots and left without finishing the third one. A few visitors hit the reset button after exhibit usage, and a few children under age 4 accidentally hit the reset button during exhibit usage (once during another visit group’s usage).

GROUP DYNAMICS

Using the Restore the Power exhibit was most often a shared or collaborative experience. Visitors worked in pairs or groups to find fraction combinations to fill the slots. No one collaborated with visitors outside their social group, although a few individuals watched other visitors use the exhibit. Among visit groups working together, an adult typically led the activity and/or explained its significance to other group members, including children and/or other adults. Children who successfully completed the activity (i.e., filling at least one empty slot with rod combinations) received verbal and/or physical guidance from adults in the selection and placement of rods. Parents frequently encouraged children, particularly those ages 8 and older, to think about the rods as fractions when determining the ones needed to fill a slot.

MATHEMATICS-RELATED CONVERSATIONAL TRENDS

The evaluator identified a variety of conversational trends among visitors using the Restore the Power exhibit, including a few related to learning mathematics (see Table 12, next page). Overwhelmingly, adults used general coaching or instructional language to introduce and/or explain the activity (e.g., “Okay, listen to what you need to do here.”). Adults also used such language to encourage or praise children’s exhibit usage (e.g., “Yay, you did it! Give me five!”). Few, if any, children verbally led the activity.

With regard to mathematics-related learning, it was most common for adult visitors to identify specific fractions or, less frequently, the concept of fractions in general, particularly when providing instructions to children or other adults. For example, many adults referred to specific fractions when guiding children through the activity (e.g., “One-quarter plus one-third leaves you with what?”), while a few also described fractions in general (e.g., “It’s all about fractions: how many thirds do you need to create one?”). Likewise, a few children ages 8 years and older asked adults to verify their usage of fractions when selecting pieces to fit in the slots (e.g., “We need two halves to make a whole, right?”).

Some visitors used problem-solving language while attempting to put together rods in Restore the Power. For example, children and adults alike expressed enthusiasm when they successfully identified

the exhibit’s math-related challenge (e.g., “I’ve got it! You need to make it add up to one.”), and a few children expressed a desire to problem-solve independently (“I think I need a fourth, let me try it.”). Some visitors also demonstrated counting behaviors, adding up different fractions or counting aloud the number of completed rods (e.g., “We finished two; we’ve got one more to go!”). While experimenting with different pieces, a few visitors used comparisons or comparative language (e.g., “This one is too small, we need a bigger piece.”). Similarly, a few others said they experimented with the orientation of pieces (e.g., “You have to turn it the other way.”). A few children who successfully completed the activity expressed pride in their personal achievement (e.g., “Dad, come here. We got them all!”).

TABLE 12
MATHEMATICAL LANGUAGE: RESTORE THE POWER STATIONED OBSERVATION

CONVERSATIONAL TREND	EXAMPLE
Coaching/Instructional	Okay, listen to what you need to do here. You need to start with one-sixteenth, see if it will fit. Yay, you did it! Give me five!
Fractions	It’s all about fractions: how many thirds do you need to create one? One-quarter plus one-third leaves you with what? We need two halves to make a whole, right?
Problem-solving	I’ve got it! You need to make it add up to one. Oh, I get it. See, it lights up when you make a whole. I think I need a fourth, let me try it.
Counting	Four and four and four is what? We finished two; we’ve got one more to go!
Comparison	See how these are different fractions? This one is too small, we need a bigger piece.
Orientation	You have to turn it the other way. Is there a positive and negative side? There is--put the positive on that end.
Personal Achievement	Dad, come here. We got them all! Ta-da! Cool!

APPENDICES

APPENDIX A

OBSERVATION FORMS

REMOVED FOR PROPRIETARY PURPOSES

APPENDIX B

DEFINITIONS OF EXHIBIT INTENDED USE, MISUSE, AND ADDITIONAL BEHAVIORS

Main Entrance Area

Exhibit/Component	Intended Use	Misuse
1. Playing with Patterns <i>Juegos con Patronos</i>	-Places/throws balls into machine with intent to make music. -Turns crank to make music.	-Throws balls at visitors or onto floor. -Turns crank incorrectly <i>and</i> never makes music.
2. Dragon Dilemma <i>El Dilema del Dragón</i>	-Moves dragons with intent.	-Randomly moves dragons without intent.
3. Jimayan Mystery <i>El Misterio Jimaya</i>	-Places pieces into slots with intent to follow pattern. -Hits “reset” button with intent.	-Throws pieces or randomly puts into slots without intent to follow pattern. -Repeatedly hits “reset” button without intent.
4. Aim is the Game <i>Saber Apuntar es la Clave</i>	-Uses laser with intent to direct puck. -Okay to move puck without laser or with hands if intent is to hit center.	-Throws pucks at people or onto floor. -Randomly plays with laser or puck without intent.

Power-up Station/Control Central

Exhibit/Component	Intended Use	Misuse
5. Power-up Station: Bicycle	-Rides bicycle or pushes pedals with hands with intent to increase energy points on monitor. -Pushes button to add points to overall energy tally board.	-Rides bicycle or pushes pedals without intent; not looking at energy points on monitor. -Does not push button to add points to overall energy tally board.
6. Power-up Station: Hand-crank	-Cranks with hands or body with intent to increase energy points on monitor. -Pushes button to add points to overall energy tally board.	-Cranks with hands or body without intent; not looking at energy points on monitor. -Does not push button to add points to overall energy tally board.
7. Control Central: Computer Game Stations (Any of 4; all the same)	-Spins track ball, punches buttons with intent to play game.	-Randomly spins track ball / punches button repeatedly without intent to play game.
8. Control Central: Main Monitor	-Punches buttons while looking at monitor.	- Randomly punches buttons repeatedly without looking at monitor.

Individual Exhibits

Exhibit/Component	Intended Use	Misuse
9. Madam’s Newest Game <i>Juego el Nuevo de Madame</i>	-Spins wheel/s with intent to play game. -Sticks on/ uses pieces with intent to play game.	-Randomly spins wheel/s repeatedly without intent to play game. -Throws pieces at visitors or on floor. - Randomly sticks on pieces without intent to play game.
10. Rebuild Eureka <i>Reconstruye Eureka</i>	-Uses pieces with intent to build.	-Throws pieces at visitors or on floor. -Abuses pieces without intent to build.
11. Restore the Power <i>Ayúdanos a restablecer la energía</i>	-Uses pieces with intent to “restore the power.” -Hits “reset” button with intent.	-Throws pieces at visitors or on floor. - Repeatedly abuses pieces without intent to “restore the power.” -Repeatedly hits “reset” button without intent.
12. KahunaHuna Race-a-Runa <i>La Carrera del Gran Kabunahuna</i>	-Participates with intent of rebuilding road. -Moves cars on road <i>and</i> participates with intent of rebuilding road.	-Throws cars/ pieces at visitors or on floor. -Moves cars on road without participating in rebuilding of road.

Welcome to Poddleville!

Exhibit/Component	Intended Use	Misuse
13. Poddle Family Patterns <i>Patrones matemáticos de la familia Poddle</i>	-Moves “people” with intent to create a pattern. -Hits “reset” button with intent.	-Throws “people” at visitors or on floor. -Repeatedly hits “reset” button without intent.
14. Who’s Who in Poddleville <i>Quién es quién en Poddleville?</i>	-Places or throws bags onto scale with intent to affect scale balance.	-Throws bags at visitors or onto floor or scale without intent.
15. Poddleville Line-up Station/s <i>La alineación de Poddleville</i>	-Punches buttons while looking inside box. -Places, throws, or stacks pieces inside box while looking inside box.	-Randomly punches buttons without looking inside box. -Stacks or throws multiple pieces inside box without looking inside. -Throws pieces at visitors or on floor.

Space Station Area

Exhibit/Component	Intended Use	Misuse
16. Magnetite Rocket <i>Cohete de Magnetita</i>	-Hits one or more buttons with intent to stop the clock.	-Randomly hits buttons without intent to stop the clock.
17. Find Hacker Game	-Hits one or more buttons, moves track ball with intent to play game.	Randomly and repeatedly hits buttons, moves track ball without intent to play game.
18. Hacker’s Closet <i>El Armario del Hacker</i>	-Places pieces in any direction inside the “closet” with intent. -Builds on the floor with pieces with intent to build.	-Throws pieces at visitors or on floor. -Plays with pieces on the floor or elsewhere without intent to build.
19. Wig Gels <i>Pelucas de Pomada</i>	-Places or throws pieces into containers with intent, looking to see how much each container holds.	-Throws pieces at visitors or on floor. -Randomly throw pieces into containers without intent, not looking at containers.

Definitions of Additional Behaviors

Coached by an Adult	Verbal interaction
<ul style="list-style-type: none"> - Exhibit is explained to child. - Child is shown how to do exhibit. - Labels are read out loud to child. - Child is given verbal instructions. - Child answers questions posed by adult related to the action of the exhibit. - Child is helped to complete the activity. 	<ul style="list-style-type: none"> - Verbal interactions related to the exhibit between child and other visitors. - Exclamations between child and others, such as “Wow!” “Look at this one.” “Come here.” “This reminds me of . . .”

APPENDIX C

EXIT INTERVIEW GUIDES – REMOVED FOR PROPRIETARY PURPOSES

Images Used for Child Interviews

Image #1



Image#2



Image #3



Image #4



Image #5



APPENDIX D

STATIONED OBSERVATION FORMS

REMOVED FOR PROPRIETARY PURPOSES

APPENDIX E

LIST OF STATISTICAL ANALYSES RUN ON THE *CYBERCHASE: THE CHASE IS ON!* TIMING AND TRACKING DATA

MANN-WHITNEY U

Gender		Total time
Ages (2 groups)		Total stops
Level of crowding		Time spent at each individual exhibit
Language spoken	x	Total stops made at each individual exhibit
Exhibition site		Total incidence of each behavior
Character Presence (Digit)		

CHI-SQUARE STATISTIC

Gender		
Ages (2 groups)		Incidence of each behavior
Level of crowding	x	Stops made at each individual exhibit
Language spoken		
Exhibition site		

APPENDIX F

VISITOR BEHAVIOR

TABLE i

NUMBER OF VISITORS WHO INITIATED ENGAGEMENT WITH INDIVIDUAL EXHIBITS

EXHIBIT COMPONENT	# VISITORS STOPPED AT EXHIBIT	# VISITORS WHO INITIATED ENGAGEMENT	
		ADULTS	CHILDREN
Aim is the Game	75	10	55
Playing with Patterns	72	8	53
Control Central: Computer Game Stations	71	9	59
Power-up Station: Bicycle	63	7	46
Kahuna-Huna Race-a-Runa	63	5	53
Power-up Station: Hand Crank	62	5	48
Rebuild Eureka	48	6	39
Restore the Power	40	7	32
Hacker's Closet	38	4	29

TABLE ii

NUMBER OF VISITORS WHO INITIATED TERMINATION OF INDIVIDUAL EXHIBITS

EXHIBIT COMPONENT	# VISITORS STOPPED AT EXHIBIT	# VISITORS WHO INITIATED TERMINATION	
		ADULTS	CHILDREN
Aim is the Game	75	10	39
Playing with Patterns	72	12	35
Control Central: Computer Game Stations	71	10	43
Power-up Station: Bicycle	63	11	35
Kahuna-Huna Race-a-Runa	63	10	33
Power-up Station: Hand Crank	62	11	32
Rebuild Eureka	48	4	32
Restore the Power	40	8	20
Hacker's Closet	38	6	24

TABLE iii**NUMBER OF VISITORS WHO DEMONSTRATED OTHER VERBAL INTERACTION AT INDIVIDUAL EXHIBITS**

EXHIBIT COMPONENT	# VISITORS STOPPED	# VISITORS OTHER VERBAL INTERACTION
Aim is the Game	75	26
Restore the Power	40	16
Playing with Patterns	72	15
Magnetite Rocket	82	15
Power-up Station: Hand-crank	62	13
Kahuna-Huna Race-a-Runa	63	13
R-Fair City	66	11
Jimayan Mystery	43	11
Who's Who in Poddleville	61	10
Hacker's Closet	38	10
Control Central: Computer Game Stations	71	9
Poddleville Line-up Station	55	8
Dragon Dilemma	47	8
Find Hacker	31	8
Power-up Station: Bicycle	63	7
Poddle Family Patterns	45	6
Control Central: Main Monitor	47	4
Rebuild Eureka	48	4
Wig Gels	30	4

TABLE iv**NUMBER OF VISITORS COACHED BY AN ADULT AT INDIVIDUAL EXHIBITS**

EXHIBIT COMPONENT	# VISITORS STOPPED	# VISITORS COACHED
Aim is the Game	75	36
Playing with Patterns	72	30
R-Fair City	66	30
Jimayan Mystery	43	26
Poddleville Line-up Station	55	23
Magnetite Rocket	82	22
Control Central: Computer Game Stations	71	22
Poddle Family Patterns	45	22
Power-up Station: Hand-crank	62	19
Who's Who in Poddleville	61	19
Dragon Dilemma	47	18
Restore the Power	40	18
Power-up Station: Bicycle	63	16
Control Central: Main Monitor	47	14
Kahuna-Huna Race-a-Runa	63	13
Find Hacker	31	12
Hacker's Closet	38	11
Rebuild Eureka	48	10
Wig Gels	30	8

TABLE v**NUMBER OF VISITORS WHO MISUSED INDIVIDUAL EXHIBITS**

EXHIBIT COMPONENT	# VISITORS STOPPED	# VISITORS MISUSED
Magnetite Rocket	82	29
Playing with Patterns	72	26
Who's Who in Poddleville	61	18
R-Fair City	66	16
Kahuna-Huna Race-a-Runa	63	15
Poddleville Line-up Station	55	14
Rebuild Eureka	48	12
Wig Gels	30	11
Poddle Family Patterns	45	8
Dragon Dilemma	47	8
Find Hacker	31	8
Control Central: Computer Game Stations	71	7
Control Central: Main Monitor	47	7
Aim is the Game	75	6
Hacker's Closet	38	5
Power-up Station: Hand-crank	62	4
Power-up Station: Bicycle	63	4
Jimayan Mystery	43	3
Restore the Power	40	2

TABLE vi**OTHER BEHAVIORS AT INDIVIDUAL EXHIBITS**

EXHIBIT COMPONENT	# VISITORS STOPPED	BEHAVIOR	# VISITORS WHO DID BEHAVIOR
Playing with Patterns	72	Used at least one card	13
		Used Crank	36
Power-up Station: Bicycle	63	Pushed button	24
Power-up Station: Hand-crank	62	Pushed button	22
Control Central: Main Monitor	47	Pushed button	28
R-Fair City	66	Put piece in wheel	27
		Kept score	10
Poddleville Line-up Station	55	Used flipbook	17
		Pushed buttons	26
Wig Gels	30	Used flip panels	10

APPENDIX G

REMOVED FOR PROPRIETARY PURPOSES