

A Front-End Evaluation of *MarsQuest*

**Prepared for
The Space Science Institute**

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Table of Contents

List of Tables	ii
Executive Summary	iii
Discussion and Recommendations	viii
Introduction.....	1
Methodology	2
Data Analysis	2
Method of Reporting	3
I. Standardized Questionnaires: Principal Findings.....	4
Visitor Demographics.....	4
Interest in Mars.....	5
Familiarity with Mars	9
Sources of Information	13
Importance and Expectations of Up-to-Date Information.....	15
Importance of Exploring Mars	17
Engaging Exhibition Title	19
II. In-Depth Interviews: Principal Findings.....	20
Interviewee Demographics.....	20
Attention to Media Coverage and Prior Knowledge.....	20
Objective and Personal Meaning of the Mars Mission	22
Value of Exploring Mars	24
Familiarity with Mars Topics	27
Images of Mars	29
Mars as a Real Place.....	34
Interpretive Strategy	38
Other Interviewee Comments and Suggestions	40
References.....	42
Appendices.....	Error! Bookmark not defined.

List of Tables

Table I.1. Respondent Characteristics in Percent	5
Table I.2. Interest in Learning about Mars in Percent	6
Table I.3. Reasons for Interest Ratings in Percent.....	7
Table I.4. Interest in Mars Topics in Percent.....	8
Table I.5. Differing Interests in Mars Topics in Percent	9
Table I.6. Familiarity with Mars Topics in Percent	11
Table I.7. Gender Differences in Familiarity with Mars Topics	12
Table I.8. Age Group Differences in Familiarity with <i>War of the Worlds</i>	12
Table I.9. Education Level Differences in Familiarity with Mars Topics	13
Table I.10. Sources of Mars Information in Percent.....	14
Table I.11. Differing Audience Segments and Sources of Mars Information in Percent	15
Table I.12. Importance of Up-to-Date Information in Percent	16
Table I.13. Time Frame Expectations of Exhibition’s Mars Information in Percent	17
Table I.14. Importance of Exploring Mars in Percent	18
Table I.15. Gender Differences in Rating Importance of Exploring Mars	19
Table I.16. Exhibition Title Preference in Percent	19
Table II.1. Interviewee Demographics	20
Table II.2. Attention to Media Coverage of the Mars Mission	21
Table II.3. Most Appealing Mars Image.....	30
Table II.4. Least Appealing Mars Image	32
Table II.5. Image That Makes Mars Feel Like a Real Place	35
Table II.6. Most Appealing Interpretive Strategies	39

EXECUTIVE SUMMARY

Only selected highlights of the study are included in this summary. Readers are urged to read the body of the report for a more detailed account of the findings.

INTRODUCTION

This report presents findings from a front-end evaluation of a traveling exhibition, funded by the National Science Foundation and currently entitled *MarsQuest*, under development by the Space Science Institute. This 5,000 square-foot exhibition is planned to act as an educational ambassador for the upcoming decade of Mars exploration. As these next ten years will revolutionize understanding of the Martian planet and climate, *MarsQuest* will be bringing new findings to the public through hands-on exhibits, computer interactives, large-scale images and dioramas, a planetarium show, and other media.

In order to provide exhibit planners with information about their audience during the development phase of the exhibition, this front-end evaluation was designed to identify ways in which the exhibition content can be humanized and made accessible. The specific objectives of the evaluation were to determine:

- visitors' conceptions of, associations with, and background knowledge of Mars
- effectiveness of comparing Mars to Earth as an interpretive strategy
- barriers to the subject for girls, women, and minorities
- the most engaging exhibition title.

METHODOLOGY

To understand visitors' relationship with the topic of Mars, two data collection techniques were implemented: a standardized questionnaire (see Appendix A) and in-depth interviews (see Appendix B). Hence, the data presented in this report are both quantitative and qualitative in nature.

I. STANDARDIZED QUESTIONNAIRES: PRINCIPAL FINDINGS

During five days in October 1997, 241 questionnaires were completed by adult visitors to the National Air and Space Museum.

Visitor Characteristics

- Approximately two-thirds of the respondents were male, and about one-third were female.
- Respondents ranged in age from 18 to 75, with three-fifths between the ages of 25 and 44.
- More than two-thirds of respondents had attended four or more years of college, with 29 percent having completed a postgraduate degree.

Interest in Mars

Interest in Learning about Mars and Mars Exploration

Respondents were asked to rate on a 7-point scale if they were not interested (1) or very interested (7) in learning about Mars and Mars exploration. After rating their interest, respondents were asked to give a written explanation for their rating.

- Eighty-five percent of respondents have high interest in learning about Mars; that is, they rated it a 5, 6, or 7. In fact, over one-third of respondents are very interested (i.e., rated it a 7).
- Although analyses of variance show that level of interest is not associated with any particular group of visitors, three-fifths of respondents with low interest are women.
- As explanation for their rating, respondents gave a variety of different reasons, which were grouped into thirteen distinct categories. While responses are fairly evenly dispersed across the categories, the three most frequent explanations for interest in Mars are: general interest in space, the recent Mars mission, and future Mars exploration.

Interest in Mars Topics

Respondents were asked to choose up to four topics about Mars that most interested them.

- Seventy-one percent of respondents are interested in how Mars is similar to or different from Earth, followed by life on Mars (63 percent) and the future of Mars exploration (56 percent).
- Men are more likely than women to be interested in the future of Mars exploration.

Familiarity with Mars

To gauge visitors' familiarity with Mars, respondents were asked to rate on a 7-point scale if they were not familiar (1) or very familiar (7) with a variety of topics related to Mars.

- The mean ratings and frequency distributions of the Mars topics suggest that respondents are not particularly familiar with any of the topics. The topic with which respondents are most familiar is the Mars Pathfinder (mean=4.64, \pm 1.90), followed by cartoons with Martians (mean=4.35, \pm 2.03) and *War of the Worlds* (mean=4.27, \pm 2.08).
- Respondents strongly indicated, through low mean ratings, that they are unfamiliar with all of the Martian terrain features listed. In fact, four-fifths of respondents are unfamiliar (gave ratings of 1, 2, or 3) with Ares Vallis, Olympus Mons, and Valles Marineris.
- Compared to women, men are more familiar with *War of the Worlds*, the face on Mars, Mars Global Surveyor, and Lowell's canals.

Sources of Information

- When asked what their top four information sources about Mars were, respondents chose news media, with 73 percent selecting television news and 66 percent picking newspapers.
- Women are more likely than men to use television comedy, drama, and cartoons to obtain information about Mars.

Importance and Expectations of Up-to-Date Information

Importance of Including Up-to-Date Information in the Exhibition

Respondents were asked to rate on a 7-point scale whether including the most current information about Mars in the exhibition was not important (1) or very important (7).

- In general, respondents highly value the inclusion of current Mars information in the exhibition (mean=5.54, \pm 1.31), and, in fact, nearly one-third of respondents think current information is very important (i.e., rated it a 7).

Expectations of Up-to-Date Information

- Overall, respondents' time frame expectations are almost evenly spread across the categories, which ranged from the same day to within twelve months. Over one-quarter of respondents expected information from within a month (26 percent). One-fifth of respondents would accept information from within three months (21 percent).

Importance of Exploring Mars

Respondents were asked to use a 7-point scale to rate two statements regarding the importance of exploring Mars. The first simply asked whether exploring Mars is not important (1) or very important (7). The second asked how important exploring Mars is to understanding Earth and its place in the universe.

- In general, respondents think Mars exploration is important. Over four-fifths of respondents rated Mars exploration a 5, 6, or 7, with over one-third rating the statement as very important (i.e., 7).
- Respondents also found exploring Mars in order to better understand Earth to be important, as over four-fifths of respondents gave a rating of 5, 6, or 7 to this statement.
- As compared to women, men are more likely to place greater importance on exploring Mars.

Engaging Exhibition Title

- None of the exhibition titles received overwhelming support from respondents, as many of the titles had similar frequencies. *Destination: Mars* received the most support (40 percent).

II. IN-DEPTH INTERVIEWS: PRINCIPAL FINDINGS

During five days in October 1997, a total of 41 open-ended interviews were conducted with 12 teens and 29 adults at the National Air and Space Museum.

Interviewee Demographics

- The sample has about equal numbers of men and women. Interviewees ranged in age from 12 to 68, with nearly two-fifths being between the ages of 25 and 44.

Attention to Media Coverage and Prior Knowledge

Interviewees were asked: “Have you been keeping up with any of the news coverage of the Mars mission? If so, what in particular piqued your interest?”

- From the 21 adults who stated they had followed at least some of the media coverage of the mission, approximately one-half talked about the mission in terms of its success.
- The 7 teens who followed the Mars mission either simply stated the existence of the mission or mentioned specific activities of the Sojourner rover.

Objective and Personal Meaning of the Mars Mission

Interviewees were asked if they drew any meaning from the Mars mission.

- Most adults viewed the Mars mission as having meaning to the United States and to scientific progress.
- A few individuals found personal meaning in the Mars mission, saying that the mission changed the way they felt about Mars and space exploration.
- Most teens were unable to articulate any meaning for the Mars mission.

Value of Exploring Mars

Interviewees’ Perceptions of What Scientists Value

Interviewees were asked: “Why do you think scientists are so excited about exploring Mars?”

- Most adults and teens said scientists are excited about exploring Mars because of professional interest.
- Some adults explicitly stated that they shared scientists’ excitement.

Interviewees’ Personal Values

Interviewees were asked: “What do you think is the value of exploring Mars?”

- About three-fifths of adults commented on the inherent importance of learning and discovery. In fact, most adult interviewees strongly valued “pure exploration” and “discovery for discovery’s sake” regardless of any benefit or outcome.

- About half of the teens placed high value on the new information that could be gained from further study of Mars, and some talked about how this new knowledge could be used in future missions.

Familiarity with Mars Topics

Interviewees were shown a list of six Mars topics and were asked to talk about those with which they felt comfortable.

- Almost all of the adults referred to the Mars mission in their responses, and, in fact, several interviewees did not select a topic from the list but rather acknowledged the existence of the Pathfinder mission or mentioned a few anecdotes from the mission.
- Teens had mixed responses. Most teens talked about the Mars topics in light of textbooklike facts learned at school. A few talked about aliens, and a few talked about the Pathfinder.

Images of Mars

Interviewees were shown three pictures of Mars: a whole planet image taken by Viking Orbiter 1, an artist's rendition of a dust storm on Mars, and an image of the Martian landscape, with the Sojourner rover, taken by Pathfinder. They were then asked to choose the most and least appealing images and to explain their choice.

- In general, adults and teens had contrasting opinions about the Sojourner image and the artist's rendition. Most adults find the Sojourner image to be the most appealing and the artist's rendition the least appealing, while teens prefer the artist's rendition and are unenthusiastic about the Sojourner image.
- Adults chose the Sojourner image as the most appealing because of its details, authenticity, sense of scale, inclusion of the Sojourner, and similarity in appearance to Earth. Adults disliked the artist's rendition because they questioned its accuracy and found its style to be too unrealistic.
- Teens liked the bright colors and action of the artist's rendition, saying it "looks like Mars" to them. The calm nature of the Sojourner image did not fit the teens' conceptions of what Mars should look like, and this, as well as its lack of action, made teens dislike it.

Mars as a Real Place

Reasons Mars Is a Real Place

Interviewees were told that to scientists Mars is a real place and were then asked to explain how Mars is a real place.

- Most of the adults said that Mars is a real place because people can scientifically study it, send human-made machines there, and see images of it.
- Most teens did not explain how Mars is a real place but rather reaffirmed the existence of Mars.

Images That Make Mars Feel Like a Real Place

After talking about what the phrase, “Mars is a real place” means, interviewees were asked if any of the pictures shown earlier make Mars feel like a real place to them.

- Almost all of the adults and one-half of the teens thought the Sojourner image made Mars feel like a real place.
- While most of the adults talked about how the presence of the rover in the Sojourner image makes Mars feel real to them, teens gave varied reasons, including the Earth-like land formations depicted in the image and the quality of the image itself.

Exhibits That Would Make Mars Feel Like a Real Place

Interviewees were told that an exhibition about Mars was being planned and that one of the goals of the exhibition was to make Mars feel like a real place. They were then asked what should be included in the exhibition to fulfill this goal.

- About one-third of the adults said the exhibition being planned should make visitors feel like they are visiting Mars by including a mock Mars environment or by simulating either the experience of traveling to Mars or colonizing it.
- Like the adults, many teens suggested that the exhibition contain simulations of the Martian environment or of space travel.

Interpretive Strategy

To test three different interpretive strategies, interviewees were shown the same picture of Olympus Mons with three different captions and were asked to choose which caption explained the information in the clearest manner.

- Adults favored both the Mars/Earth and Mars/solar system comparisons, whereas teens overwhelmingly chose the Mars/solar system comparison.
- Adults chose the two comparisons because they like being able to compare the unfamiliar with something familiar. Teens prefer the drama of “largest in the known solar system,” the description used in the Mars/solar system comparison.

DISCUSSION AND RECOMMENDATIONS

This front-end evaluation captures visitors' thoughts, feelings, and opinions about Mars in what could be considered idealized conditions, as the interviews were conducted following the successful completion of the Mars Pathfinder mission and subsequent media coverage. Because of these conditions, these data can be seen as the best case scenario. In two years time at the opening of *MarsQuest*, visitors' interest in Mars will most likely have decreased. Also, it is interesting to note that even under optimum conditions, women expressed lower interest in the future of Mars exploration and placed lesser importance on its exploration than men did. Thus, talking all of this into consideration, it important to keep in mind that the content of the exhibition, in order to be successful regardless of the visitors' level of interest or the success of future Mars missions, will need to connect cognitively and emotionally to visitors and show them the relevancy of Mars exploration.

VISITORS' CONCEPTIONS, ASSOCIATIONS, AND PRIOR KNOWLEDGE OF MARS

Cognitive Connections to Mars

For most adults, the Mars Pathfinder mission is the common reference point for Mars. Although most adults stated they had followed the media coverage of the Pathfinder mission, their knowledge about the mission in particular, and about Mars in general, lacks depth. While most adult interviewees had a sense that the Pathfinder mission was a success, they were unable to talk about definitive findings from the mission or about Mars's physical attributes. In general, the questionnaire respondents, who are all adults, are not particularly familiar with any of the Mars topics and are least familiar with Martian terrain features.

In contrast with the adults who spoke mainly of the Pathfinder mission, teens spoke confidently about specific physical characteristics of Mars such as temperature and atmospheric conditions. The teens felt certain about the facts that they relayed, but often confused conditions on Mars with those on other planets. Teens probably did not focus their comments on the Pathfinder mission because only about one-half of them had followed the mission, and even these teens simply acknowledged its existence.

Because interviewees reported knowing so little about Mars and because questionnaire respondents value the inclusion of current Mars information in the exhibition being planned, but are ambivalent about their time frame expectations for this information, content advisers and exhibition developers should not be overly concerned with providing near real-time data from future Mars missions. Supplying the most current analyzed information about Mars and presenting it as such is of greater importance. Also, both adult and teen interviewees are so unfamiliar with Mars that new, raw data would not be particularly useful to them.

Another concern of content advisers and developers surrounded the role science fiction plays in visitors' understanding of Mars. Although questionnaire respondents, in general, were familiar with popular culture references to Mars, women were less familiar than men with *War of the Worlds*, the face on Mars, and Lowell's canals. During the interviews, only a few adults and teens discussed aliens. One teen, in particular, talked extensively about aliens in reference to possible life on Mars. While adults generally made distinctions between science and science

fiction, teens seemed to combine these in their understanding of Mars and, in some cases, may have difficulty distinguishing between fact and fiction.

Recommendations

- Developers should assume that visitors have no prior knowledge of Mars.
- Because questionnaire respondents were unfamiliar with Martian terrain features, the site-based organization chosen for the exhibition is a good way to introduce visitors not only to the physical characteristics of Mars but also to general space science concepts.
- Developers should refrain from making comparisons between Mars and other planets, because this might reinforce misconceptions teens already have about Mars (e.g., atmospheric conditions).
- Including the most current analyzed data from Mars and making visitors aware that it is new information should take precedence over including new, raw data.
- Science fiction should be excluded from the exhibition, because it may reinforce popular culture notions about Mars rather than dispel them and further confuse teens' ability to differentiate between science fiction and science. Exclusion of science fiction might also make the exhibition more approachable to women, who may be unfamiliar with popular references, and might feel alienated by the very devices meant to make Mars more accessible.

Emotional Connections to Mars

While most visitors think the Pathfinder mission is important, they do not connect personally or emotionally to the mission or to Mars. When adult and teen interviewees were asked about the meaning and value of exploring Mars, almost all talked about meaning and value in terms of patriotism or what scientists think is important rather than about meaning and value in their own lives. In fact, most adults and teens do not see the mission as having any relevance to their lives.

The few adults who feel an emotional connection with Mars placed it within a framework of human experience. For example, visitors are either passionate about an issue that relates to people, such as possible life on Mars or human colonization, or find Earth-like qualities in the Sojourner image. Two interviewees, in particular, spoke very passionately about Mars exploration, focusing primarily on people: how they personally became interested in Mars as well as how scientists are passionate about their work.

Recommendations

- State explicitly how Mars exploration is relevant to visitors' lives.
- Help visitors make an emotional connection to Mars by presenting issues about which they are passionate.
- Humanize the exhibition by including stories from lay people describing how they became interested in Mars and from scientists conveying excitement about their work. This recommendation is made despite the fact that few questionnaire respondents showed interest in stories about the people behind the Mars missions, because respondents generally will not choose topics with which they are unfamiliar or have never considered as possibilities.

Reactions to Images of Mars

Adults and teens value very different visual elements in the Mars images. Adults prefer the photographic qualities of the Sojourner image, while teens like the colors and action of the artist's rendition. This may be, in part, because adults are looking to the images for tangible information about Mars, whereas teens simply enjoy the action-filled scene. Furthermore, adults question not only the artist's accuracy and reason for portraying Mars in such a manner but also the meaning that the artist is trying to convey. If the artist's rendition had been accompanied by an explanatory label, adults might not have reacted so negatively to it.

In contrast with the adults, most teens found the Sojourner image to be the least appealing. One reason may be that nearly half the teens are unfamiliar both with the image itself and with the Mars mission. Teens may have been less negative about the image if its meaning and significance were clearly explained. A second possible reason for the teens' dislike of this image relates to its style. Teens are more attuned to video, animation, and other action-filled media rather than they are to static images.

Interviewees were also asked to identify which image makes Mars feel like a real place. Almost all of the adults and one-half of the teens thought the Sojourner image made Mars feel real to them. Adults and teens attribute this feeling to the seeing the human-made rover in the Martian landscape as well as to the image's photographic quality. Some of the adults appreciate the image's perspective, in that the landscape includes the horizon and sky with a detailed foreground. In effect, the Sojourner image makes Mars feel like a real place to these adults because they know how to read the image. Other adults said the Sojourner image gave them a sense of scale, because its detailed nature allows them to compare the size of the rocks with that of the rover.

It is interesting to note that interviewees' choices for the most appealing image and the one that makes Mars feel like a real place did not always correspond. This disjunction is most dramatic among teens, who generally preferred the artist's rendition, but of those only two said it made Mars feel like a real place.

Recommendations

- Each image in the exhibition must be carefully selected to serve a purpose, and that purpose should be clearly conveyed to visitors. Because visitors construct their own meanings, using images as backdrops and without explanatory labels may reinforce misconceptions.
- Adults and teens prefer different kinds of images. Thus, both realistic ones like the Sojourner image and fictional ones like the artist's rendition should be included and incorporated using a range of media.
- For images to make Mars feel like a real place to visitors, the images need to convey a sense of scale and give other visual clues that will help them to be read. In some cases, interpretive text may be needed to aid visitor understanding of the images.

EFFECTIVENESS OF THE MARS/EARTH INTERPRETIVE STRATEGY

While the Mars/Earth comparison was preferred by most adults, the Mars/solar system comparison was preferred by most teens and some adults. These findings confirm that both audiences find comparisons to be useful in understanding Mars. Adults stated that they like being able to compare something unfamiliar on Mars to something familiar on Earth. Adults also responded positively to another Mars/Earth comparison in the questionnaire. Almost three-quarters of respondents are interested in how Mars is similar to and different from Earth. Most respondents also think that exploring Mars to better understand Earth is highly important. It is interesting to note that none of the adult interviewees suggested, of their own accord, that exploring Mars could lead to better understanding of Earth.

Several of the adults chose the Mars/solar system comparison. These adults prefer being given both a comparison and the volcano's height in feet. A few adults also stated that they appreciated how this comparison did not rely on knowledge of United States geography as the Mars/Earth comparison did.

Most teens chose the Mars/solar system comparison. Teens prefer the dramatic description, "largest in the known solar system," used in this comparison. Also, as discussed earlier, when teens talked about Mars they often compared it to other planets rather than to Earth.

Recommendations

- Developers should make the Mars/Earth interpretive strategy explicit to visitors and incorporate it throughout the exhibition.
- Because the two interpretive strategies that made comparisons were highly successful with all visitors, developers should employ comparisons in text and graphics.

- Visitors' knowledge base can be quite variable. Because of this, the exhibition should use graphics to make visual comparisons rather than depending on audience members own familiarity and ability to make mental comparisons.

ISSUES THAT DEVELOPERS MAY NEED TO ADDRESS

Although visitors' responses focused on the Pathfinder mission in the questionnaire and interviews, there are two other topics that both adults and teens expressed interest in and discussed: life on Mars and human colonization of Mars. In fact, if the evaluation had taken place at a different time, not following so closely behind the Pathfinder mission, these topics might have been even more prevalent.

Visitors either feel very strongly about the search for life on Mars and human colonization or do not even consider these possibilities. It was unclear from most interviews if visitors fully understood that scientists are searching for evidence of microscopic life on Mars and are not anticipating finding multi-cellular organisms. Visitors also made assumptions about colonization. A few adults and most teens talked about the colonization of Mars as if it was inevitable and simply a matter of sending people and supplies. While some of the adults did raise issues concerning colonization, teens did not address barriers or ethical issues.

INTRODUCTION

This report presents findings from a front-end evaluation of a traveling exhibition, funded by the National Science Foundation and currently entitled *MarsQuest*, under development by the Space Science Institute. This 5,000 square-foot exhibition is planned to act as an educational ambassador for the upcoming decade of Mars exploration that the National Aeronautics and Space Administration launched with its 1997 Global Surveyor and Pathfinder missions. As the next ten years of exploration will revolutionize understanding of the Martian planet and climate, *MarsQuest* will be bringing new findings to the public through hands-on exhibits, computer interactives, large-scale images and dioramas, a planetarium show, and other media.

Front-end evaluation is often conducted to provide exhibit planners with information about their audience during the planning stages of an exhibition. Randi Korn & Associates designed this front-end evaluation to identify ways in which the exhibition content can be humanized and made accessible.

The objectives of the evaluation, derived from the exhibition's educational goals and objectives, were to determine:

1. Visitors' conceptions of, associations with, and background knowledge of Mars
 - What are visitors' impressions of Mars? Where are they getting these impressions?
 - How do visitors connect with Mars both emotionally and cognitively?
 - How do visitors respond to images of Mars?
 - What are visitors' primary sources of information about Mars?
 - What effect has the media coverage of the Pathfinder mission had on visitors?
 - How important is near real-time data?
2. Effectiveness of comparing Mars to Earth as an interpretive strategy
 - Which interpretive strategy do visitors think conveys information in the clearest manner?
 - What comparisons, if any, do visitors make between Mars and Earth?
 - What do visitors perceive as the value of Mars exploration?
 - How do visitors respond to the idea that "Mars is a real place"?
3. Barriers to the subject for girls, women, and minorities
 - How can Mars be made more appealing to girls, women, and minorities?
4. The most engaging exhibition title.

METHODOLOGY

To understand visitors' relationship with the topic of Mars, two data collection techniques were implemented: a standardized questionnaire and in-depth interviews.

Standardized Questionnaires

A standardized questionnaire, composed of eight close-ended questions and two open-ended items, was used to collect quantitative data about visitors' demographic characteristics, opinions, and knowledge base. (See Appendix A for a sample of the survey.) A standardized questionnaire was employed because it is the most efficient method of collecting experiences from a large number of visitors.

Randi Korn & Associates administered the surveys at the National Air and Space Museum (NASM) in Washington, D.C., at the exits of two exhibitions: *How Things Fly* and *Where Next, Columbus?* A continuous random sampling procedure was used to select visitors for participation. According to this procedure, survey administrators approached the first eligible visitor (18 years or older) to exit the exhibition, inviting her or him to participate in the survey. When the visitor had completed the questionnaire, she or he was thanked for participating, and the survey administrator awaited the next eligible visitor.

In-depth Interviews

The purpose of conducting open-ended interviews is to encourage and motivate interviewees to express their opinions and feelings, recollect memories and associations, and share with the interviewer thoughtful responses to more complex questions. Open-ended interviews produce data rich in information because interviewees talk about their experiences from a very personal perspective.

Upon entering the sound wave area of the *How Things Fly* exhibition, eligible visitors (12 years old or older) were selected (following the continuous random sample method described above) and asked to answer a few questions (see Appendix B) and look at some images of Mars (see Appendix C). The interview guide was intentionally open-ended to allow interviewees the freedom to discuss what they felt was meaningful. All interviews were tape-recorded with participants' awareness and transcribed to facilitate analysis.

DATA ANALYSIS

Quantitative data were entered into a computer and analyzed using SPSS PC+, a statistical program for personal computers. Frequencies and percentages were calculated for all categorical variables (e.g., gender, attention to media coverage of the Mars mission). Summary statistics, including the mean (average) and standard deviation (spread of scores: \pm), were calculated for all rating scales. To examine the relationship between two categorical variables (e.g., gender and interest in life on Mars), cross-tabulations were computed to show the joint frequency distribution of the two variables, and the chi-square statistic (X^2) was used to test the significance of the relationship. Analyses of variance were run to compare the mean scores of two or more independent groups (e.g., college graduates and non-college graduates). When three groups

were involved in the analysis and a significant *F*-value resulted, a Scheffé post hoc test was run to pinpoint where, among the groups, the differences lay.

A level of significance of $p < 0.05$ was used in this study. This means that when a statistical test, such as a test of a relationship, is significant at a probability level of $p < 0.05$, the magnitude of the relationship being tested would occur purely by chance fewer than 5 in 100 times. Because the odds are so low that the relationship would occur purely by chance, there is a good reason to be confident that the relationship really exists.

METHOD OF REPORTING

The data presented in this report are both quantitative and qualitative in nature. Findings from the standardized questionnaire are presented first, followed by findings from the interviews. For the quantitative data, tables are regularly used to display the information in a manner that makes it easily accessible. Percentages within tables do not always equal 100 due to rounding. Because respondents often omit survey items for various reasons and because they were occasionally instructed to skip questions based on previous replies, the number of visitors (*n*) responding to a survey question is noted in each table.

Interviewees' verbatim quotations (edited for clarity) and a few summary tables are used to illustrate major trends in the qualitative data and to convey visitors' thoughts and feelings as fully as possible. The findings within each topic are presented in descending order, starting with the most frequently occurring. Interviews with adults and teens are analyzed separately to facilitate not only the development of particular exhibition components but also the educational programs for youth that will accompany *MarsQuest*.

Findings are reported in two main sections as follows:

- I. Standardized Questionnaires
- II. In-depth Interviews

I. STANDARDIZED QUESTIONNAIRES: PRINCIPAL FINDINGS

A total of 241 questionnaires were completed during five days in October 1997. Of the 403 English-speaking visitors who were approached, 162 declined to participate. Thus, the refusal rate was 40 percent, a relatively high rate for museum visitor surveys, but not unlike the 43 percent refusal rate experienced by RK&A during the front-end evaluation for the Space Science Institute's *Electric Space: The Sun-Earth Environment* exhibition, also conducted at NASM.

VISITOR DEMOGRAPHICS

As Table I.1 shows, approximately two-thirds of the survey respondents were male, and about one-third were female (63 percent and 37 percent, respectively). Respondents ranged in age from 18 to 75, with a mean age of 36. Three-fifths of the respondents (61 percent) were between the ages of 25 and 44. Not only were respondents relatively young, they were also well educated. More than two-thirds of respondents had attended four or more years of college with 29 percent having completed a postgraduate degree.

While the gender breakdown of Mars questionnaire respondents is almost identical to visitor statistics collected by NASM in 1988, (Doering and Black, 1989), the age distribution differs. NASM reported more male than female visitors (60 percent and 40 percent, respectively), which is similar to the questionnaire respondents' 63 percent male and 37 percent female breakdown. NASM data also show 50 percent of visitors being between the ages of 25 and 44, but 61 percent of questionnaire respondents were in this category. The younger audience reflected in the questionnaire participants is more representative of science centers, the target venue for *MarsQuest*, as Korn (1995) found that 63 percent of science center visitors were between the ages of 25 and 44.

Table I.1.
Respondent Characteristics in Percent

Gender (n = 241)	%
Male	62.7
Female	37.3
Age (n = 236) (mean = 36)	%
18-24	15.4
25-34	33.2
35-44	27.8
45-54	15.8
55-64	6.2
65+	1.7
Highest Level of Education (n = 241)	%
Some high school or less	2.5
Graduated high school	10.0
Vocational/technical school	2.5
Some college (1-3 years)	17.6
Graduated college	27.6
Some postgraduate work	11.3
Postgraduate degree	28.5

INTEREST IN MARS

Interest in Learning about Mars and Mars Exploration

Respondents were asked to rate on a 7-point scale if they were not interested (1) or very interested (7) in learning about Mars and Mars exploration (see Table I.2). Eighty-five percent of respondents chose a rating of 5, 6, or 7; in other words, they had high interest in learning about Mars. In fact, over one-third of respondents were very interested (i.e., rated it a 7). Only 5 percent of respondents expressed low interest in Mars by choosing a rating of 1, 2, or 3. A few respondents (10 percent) were undecided or lacked strong feelings about Mars (i.e., rated it a 4). The resultant mean rating fell on the higher end of the scale, suggesting that respondents, as a group, have a relatively high interest in learning about Mars (mean = 5.74, ± 1.27).

Table I.2.
Interest in Learning about Mars in Percent

Rating Scale (n=241)	1 ← Not Interested ← 4 → Very Interested → 7							Mean	±
	1	2	3	4	5	6	7		
	%	%	%	%	%	%	%		
Interest in learning about Mars and Mars exploration	0.8	1.2	3.3	9.5	22.8	27.4	34.9	5.74	1.27

Although analyses of variance show that level of interest in learning about Mars is not associated with any particular group of visitors, the gender and age composition of respondents who have low interest in Mars differs from the demographics of the sample as a whole. Three-fifths of respondents with low interest are women, and two-thirds are between the ages of 18 and 34 years. The total questionnaire sample has more men (three-fifths) and is somewhat older, with the majority of respondents (three-fifths) being between the ages of 25 and 44. In both samples, two-thirds of respondents had college or postgraduate degrees.

After respondents rated their interest in Mars, they were asked to explain their rating. The response rate for this open-ended question was 74 percent. Thirteen distinct categories were found, and they appear in rank order in Table I.3. Almost one-fifth of respondents stated that their interest in Mars stemmed from a general curiosity about space or “exploring the unknown” (17 percent). Respondents’ interest in Mars had also been piqued by the Pathfinder and Sojourner missions and the possibility of future exploration (15 percent and 14 percent, respectively).

About one-fifth of the respondents did not explain their interest in Mars, but rather made general comments about their interest that were classified under “general enthusiasm,” “average interest,” and “comments about the exhibition.” In the “general enthusiasm” and “average interest” categories, respondents reiterated their rating by writing comments such as “great stuff” or “moderate interest in science.” The “comments about the exhibition” category contains respondents’ suggestions for and approval of the Mars exhibition being planned.

**Table I.3.
Reasons for Interest Ratings in Percent**

Reason (n=178)	%¹
General interest in space/the unknown	17.4
Recent Mars missions	15.2
Future Mars exploration/Mars as a new frontier	14.0
General enthusiasm	8.4
Life on Mars	7.9
Against/lack of interest in Mars exploration	7.3
Earth/Mars comparison	6.2
Benefits to Earth	6.2
Average interest	5.6
Lack of knowledge about Mars	5.0
Comments about the exhibition	4.5
Professional/personal connection	3.4
Miscellaneous	1.7

¹Some respondents provided more than one response, so the total percentage exceeds 100.

After completing the first question, respondents who had low interest in Mars (i.e., ratings of 1, 2, or 3) were instructed to skip the next several questions and go directly to the demographics questions at the end of the questionnaire. Hence, 13 of the 241 respondents completed only the first question and demographics questions, resulting in a base sample size (*n*) of 228 for the more specific questions about Mars.

Interest in Mars Topics

Respondents were asked to choose, from a list of ten topics and issues about Mars, the items that interested them most. They could pick up to four topics. As shown in Table I.4, almost three-quarters of respondents were interested in how Mars is similar to or different from Earth (71 percent). Almost two-thirds chose the issue of life on Mars to be of prime interest, and more than half of the respondents found the future of Mars exploration to be intriguing (63 percent and 56 percent, respectively).

The two topics that were of least interest to respondents both involve roles people play in the exploration of Mars. About one-fifth of respondents were interested in how they could participate in the exploration of Mars, and less than one-fifth wanted to know about the people behind the Mars missions (18 percent and 13 percent, respectively).

**Table I.4.
Interest in Mars Topics in Percent**

Topic / Issue (<i>n</i>=228)	%¹
How Mars is similar to or different from Earth	70.6
Life on Mars	63.2
The future of Mars exploration	56.1
What it would be like to visit Mars	44.7
Tools and technology used to study Mars	42.1
Stories and myths about Mars	39.0
History of Mars exploration	32.5
Why scientists are studying Mars	28.1
How I can participate in the exploration of Mars	18.4
Stories about the people behind the missions	12.7

¹Because respondents could choose more than one response, the total percentage exceeds 100.

To determine whether distinct groups of visitors (e.g., gender, age, education level) were interested in different Mars issues and topics, chi-square analyses were performed. As Table I.5 shows, men were more likely than women to be interested in the future of Mars exploration. Also, non-college graduates were more likely than college graduates to express interest in the similarities and differences between Earth and Mars.

**Table I.5.
Differing Interests in Mars Topics in Percent**

Topic / Issue	Male %	Female %
The future of Mars exploration**	62.3	45.1
Topic / Issue	College Graduate %	Non-College Graduate %
How Mars is similar to or different from Earth*	65.6	81.1

* $p < 0.05$ ** $p = 0.01$

FAMILIARITY WITH MARS

To gauge visitors' familiarity with Mars, respondents were asked to rate on a 7-point scale how familiar they were with a variety of topics related to Mars. Table I.6 lists each item along with its frequency distribution and mean rating in descending order. On a scale of 1 to 7, individuals unfamiliar with a topic would rate it a 1 (not at all familiar), 2, or 3 (somewhat unfamiliar). Likewise, individuals familiar with a topic would rate it a 5 (somewhat familiar), 6, or 7 (very familiar). Individuals who are somewhere between feeling somewhat unfamiliar and somewhat familiar would choose 4, the middle rating.

Most Familiar Mars Topics

Of the fourteen topics, respondents are the most familiar with the Mars Pathfinder (mean=4.64, ± 1.90). Three-fifths of respondents rated their familiarity with Pathfinder a 5, 6, or 7 (60 percent), and, in fact, one-fifth reported being very familiar with it (i.e., rated it a 7). Though many respondents were confident in their knowledge of Pathfinder, about one-quarter rated their familiarity on the lower end of the scale (i.e., rating of 1, 2, or 3) (27 percent).

Following the Mars Pathfinder, respondents are most familiar with popular culture items, with approximately half giving high familiarity ratings (i.e., ratings of 5, 6, or 7) to cartoons with Martians (mean=4.35, ± 2.03) and *War of the Worlds* (mean=4.27, ± 2.08). About one-third of respondents are unfamiliar with these two popular Mars references (both 35 percent).

Least Familiar Mars Topics

Although respondents do not show an overwhelming familiarity with any of the Mars topics, they do, indicate which topics are unfamiliar to them. These are all Martian terrain features. Respondents are the least familiar with Ares Vallis, the Pathfinder landing site (mean=1.96, ± 1.55), with over four-fifths rating it a 1, 2, or 3 (85 percent). In fact, three-fifths (60 percent) are not at all familiar with the Pathfinder landing site (i.e., rated it a 1).

Two other land formations are highly unfamiliar to respondents: the volcano Olympus Mons (mean=2.06, ± 1.74) and the canyon system Valles Marineris (mean=2.07, ± 1.61). Four-fifths of respondents gave Olympus Mons and Valles Marineris ratings of 1, 2, or 3 (82 percent and 81 percent, respectively), with about three-fifths giving each a rating of 1 (61 percent and 58 percent, respectively).

Table I.6.
Familiarity with Mars Topics in Percent

Feature / Topic (n=224)	1 ← Least Familiar ←		4	→ Most Familiar →		7	Mean	±	
	1	2	3	4	5	6			7
	%	%	%	%	%	%			
Mars Pathfinder	10.3	5.8	11.2	13.0	21.5	17.9	20.2	4.64	1.90
Cartoons with Martians	13.5	9.0	12.6	12.6	19.3	12.6	20.6	4.35	2.03
<i>War of the Worlds</i>	16.0	8.0	11.1	15.1	18.7	9.8	21.3	4.27	2.08
Mars in science fiction	13.8	10.3	10.7	20.1	21.0	11.6	12.5	4.09	1.89
Mars in movies and TV	9.4	12.5	17.0	15.2	20.5	17.4	8.0	4.09	1.77
Mars Sojourner rover	22.0	9.4	11.2	10.3	17.0	14.8	15.2	3.96	2.15
Mars, Roman god of war	25.6	9.9	13.5	13.9	13.0	10.8	13.5	3.65	2.12
The face on Mars	24.8	10.6	12.8	15.9	18.1	10.2	7.5	3.53	1.96
Mars Global Surveyor	36.8	13.5	9.0	14.3	13.5	6.7	6.3	3.00	1.98
<i>Martian Chronicles</i>	37.1	14.0	12.7	9.5	12.2	4.1	10.4	2.99	2.06
Lowell's canals	46.4	11.2	14.3	13.8	7.1	3.6	3.6	2.49	1.74
Valles Marineris	57.9	14.5	8.1	10.0	4.1	2.3	3.2	2.07	1.61
Olympus Mons	61.3	15.1	5.3	5.8	4.4	3.1	4.9	2.06	1.74
Ares Vallis	59.7	18.1	7.2	2.3	8.1	2.7	1.8	1.96	1.55

Analyses of variance were conducted to determine whether particular audience segments differed in their familiarity with the Mars topics. Statistically significant relationships were found between familiarity of Mars topics and gender, age, and education level.

The relationship of gender to familiarity with the Mars topics is statistically significant for four of the topics, as shown in Table I.7. Compared to women, men are more familiar with *War of the Worlds*, the face on Mars, Mars Global Surveyor, and Lowell’s canals.

Table I.7.
Gender Differences in Familiarity with Mars Topics

(1=Not Familiar / 7=Very Familiar)				
Feature / Topic	Male		Female	
	Mean	±	Mean	±
<i>War of the Worlds</i> *	4.49	2.10	3.88	1.98
The face on Mars**	3.79	1.93	3.05	1.94
Mars Global Surveyor**	3.27	2.10	2.52	1.65
Lowell’s canals***	2.76	1.84	2.01	1.44

* $p < 0.05$ ** $p = 0.01$ *** $p = 0.001$

Familiarity with *War of the Worlds* and respondents’ ages is another statistically significant relationship (see Table I.8). Respondents who are under 30 years old are less familiar with *War of the Worlds* than are respondents 40 and over.

Table I.8.
Age Group Differences in Familiarity with *War of the Worlds*

(1=Not Familiar / 7=Very Familiar)							
Age Groups ¹							
18-29		30 - 39		40 - 49		50+	
Mean*	±	Mean	±	Mean*	±	Mean*	±
3.69	2.08	4.10	2.10	4.91	1.88	4.97	1.90

¹To conduct analyses of variance, respondents were grouped into four age categories.

* $p < 0.05$

As Table I.9 shows, the relationship between respondents' having college degrees and familiarity with a Mars topic was statistically significant for three topics. College graduates are more familiar with the Mars Sojourner, Mars as the Roman God of War, and the Mars Global Surveyor than are non-college graduates.

Table I.9.
Education Level Differences in Familiarity with Mars Topics

(1=Not Familiar / 7=Very Familiar)				
Feature / Topic	College Graduate		Non-College Graduate	
	Mean	±	Mean	±
Mars Sojourner*	4.20	2.11	3.46	2.16
Mars, Roman god of war*	3.86	2.08	3.21	2.15
Mars Global Surveyor*	3.19	2.02	2.58	1.82

* $p < 0.05$

SOURCES OF INFORMATION

Respondents were asked to choose, from a list of 15 items, the top four information sources that have shaped their knowledge of Mars. Most respondents chose news media as their source of information, with almost three-quarters of respondents selecting television news and two-thirds picking newspapers (73 percent and 66 percent, respectively). Following the current news sources, television documentaries and magazines were chosen by approximately two-fifths of respondents (42 percent and 39 percent, respectively). The information sources chosen by the fewest respondents were fictional television programs (e.g., comedy, drama, cartoons) (9 percent) and personal contacts (e.g., parents, relatives, friends) (7 percent).

Table I.10.
Sources of Mars Information in Percent

Source (n=228)	%
TV news	73.2
Newspapers	65.8
TV documentaries	42.1
Magazines	38.6
Movies	27.2
Teachers/professors	22.8
Internet	22.4
Reference books	21.1
Scientific journals	19.3
Fiction books	15.8
Nonfiction books	12.7
TV comedy/drama/cartoons	9.2
Parents/relatives/friends	7.0
Other*	4.4
Don't know	1.3

*Other included museums, radio, NASA channel, and "Bonestell's Exploratorium of Mars"

Chi-square analyses were performed to determine whether information sources differed between the various audience segments. As shown in Table I.11, women are more likely than men to use television comedy, drama, and cartoons to obtain information about Mars. In comparison with non-college graduates, college graduates are more likely to use the newspaper and scientific journals to obtain information about Mars, while non-college graduates are more likely to use television documentaries.

Table I.11.
Differing Audience Segments and Sources of Mars Information in Percent

Information Source	Male %	Female %
TV comedy/drama/cartoons**	5.5	15.9
Information Source	College Graduate %	Non-College Graduate %
Newspaper*	70.8	55.4
TV documentaries**	36.4	54.1
Scientific journals***	25.3	6.8

* $p < 0.05$ ** $p = 0.01$ *** $p = 0.00$

IMPORTANCE AND EXPECTATIONS OF UP-TO-DATE INFORMATION

Importance of Including Up-to-Date Mars Information in the Exhibition

Respondents were asked to rate the importance of including the most up-to-date information about Mars in the exhibition being planned. As Table I.12 shows, a 7-point scale was used, which allowed respondents to indicate how important (7) or not important (1) current Mars information is to a new Mars exhibition.

In general, respondents highly value the inclusion of current Mars information in the exhibition (mean=5.54, ± 1.31), with over three-quarters rating it a 5, 6, or 7. Nearly one-third of respondents (32 percent) gave it a rating of 7 (i.e., very important). Less than one-fifth (18 percent) thought including up-to-date information was in between not important and very important (i.e., rated it a 4), and very few thought it unimportant (7 percent). In fact, none of the respondents gave a rating of 1.

Analyses of variance were conducted to see if any of the audience segments differed in their opinion of the importance of current information being in the new Mars exhibition. No statistically significant relationships were found.

Table I.12.
Importance of Up-to-Date Information in Percent

Rating Scale (<i>n</i> =226)	1 ←	Not Important ←		4	→ Very Important		→ 7	Mean	±
	1	2	3	4	5	6	7		
	%	%	%	%	%	%	%		
Including up-to-date information	0.0	0.9	5.8	17.8	22.2	20.9	32.4	5.54	1.31

Expectations of Up-to-Date Information

Interviewees were told that the exhibition being planned would present current information about Mars. They were then asked to indicate what their expectations are for “the most up-to-date” Mars information by choosing one of six time frames.

Overall, respondents’ time frame expectations are almost evenly spread across the categories. Over one-quarter of respondents expected information from within a month (26 percent). One-fifth of respondents would accept information from within three months (21 percent). An equal number of respondents expect information from within a week, six months, and twelve months (all 15 percent). Nineteen individuals would like information from the same day (9 percent).

Analyses of variance were conducted to determine whether particular audience segments differed in their time frame expectations. No statistically significant relationships were found.

Table I.13.
Time Frame Expectations of Exhibition’s Mars Information in Percent

Time Frame (n=224)	%
Within a month	26.3
Within three months	21.0
Within six months	14.7
Within twelve months	14.7
Within a week	14.7
From the same day	8.5

IMPORTANCE OF EXPLORING MARS

Respondents used a 7-point scale to rate two statements regarding the importance of exploring Mars. The first simply asked whether exploring Mars is not important (1) or very important (7). The second asked how important exploring Mars is to understanding Earth and its place in the universe.

As Table I.14 shows, respondents think both exploring Mars and exploring Mars in order to understand Earth are important (mean=5.66, \pm 1.26, and mean=5.68, \pm 1.25, respectively). Over four-fifths of respondents rated Mars exploration a 5, 6, or 7 (82 percent), with over one-third (33 percent) rating the statement as very important (i.e., giving a rating of 7). Similarly, over four-fifths gave high ratings to the importance of exploring Mars to better understand Earth (84 percent). Again, about one-third of respondents (31 percent) indicated strong support of this statement by rating it a 7. Few respondents are undecided about the statements (12 percent for the first statement, and 9 percent for the second), and few consider the statements unimportant (i.e., rated it a 1, 2, or 3) (6 percent for the first statement, and 7 percent for the second).

Table I.14.
Importance of Exploring Mars in Percent

Rating Scale (n=226)	1 ←	Not Important ←	4	→ Very Important	→ 7	Mean	±		
	1	2	3	4	5			6	7
	%	%	%	%	%	%	%		
Exploring Mars	0.0	1.3	4.9	11.9	23.5	25.2	33.2	5.66	1.26
Exploring Mars in order to understand Earth	0.0	1.8	5.3	8.8	23.0	29.6	31.4	5.68	1.25

Analyses of variance were conducted to determine whether there were any differences in opinion from particular audience segments about the importance of exploring Mars and exploring Mars to better understand Earth. One relationship is statistically significant, as shown in Table I.15. As compared to women, men are more likely to place greater importance on exploring Mars.

Table I.15.
Gender Differences in Rating Importance of Exploring Mars

(1=Not Important / 7=Very Important)		
Gender	Mean	±
Male	5.79	1.22
Female	5.41	1.30

p<0.05

ENGAGING EXHIBITION TITLE

The last question on the questionnaire asked respondents to choose, from a list of ten exhibition titles, those that would motivate them to visit the exhibition. Respondents could choose up to three titles. None of the titles received the overwhelming support of respondents, as many of the titles had similar frequencies (see Table I.16). Two-fifths of respondents (40 percent) chose *Destination: Mars* as the most engaging exhibition title, followed by five other titles, each of which received the support of more than one-quarter of respondents. The least popular title was *Mars Rocks!* which 10 individuals chose.

Table I.16.
Exhibition Title Preference in Percent

Exhibition Title (n=225)	% ¹
<i>Destination: Mars</i>	40.0
<i>Revealing the Red Planet</i>	30.2
<i>Mars: Our Future in Space</i>	29.3
<i>The Red Planet</i>	28.0
<i>MarsQuest</i>	27.1
<i>Explore Mars</i>	24.9
<i>Mars: Sci-Fi to Science</i>	18.2
<i>Of Red Soil and Blue Sunsets</i>	15.6
<i>To Mars!</i>	14.2
<i>Mars Rocks!</i>	4.4

¹Because respondents could choose more than one response, the total percentage exceeds 100.

II. IN-DEPTH INTERVIEWS: PRINCIPAL FINDINGS

A total of 41 interviews (12 teens and 29 adults) were conducted over five days in October 1997. Of the 59 English-speaking visitors who were approached, 18 declined to participate. Thus, the refusal rate was 31 percent, a relatively high rate for museum visitor interviews, but not surprising considering the time constraints of tourist visitors and other unique factors that affect the visitor experience in a Smithsonian museum.

INTERVIEWEE DEMOGRAPHICS

As Table II.1 shows, the sample includes approximately equal numbers of men and women (21 and 20, respectively). Interviewees range in age from 12 to 68; nearly two-fifths are between the ages of 25 and 44, and their mean age is 34 years.

Table II.1.
Interviewee Demographics ($n = 41$)

Gender	Teens n	Adults n	Total n
Male	7	14	21
Female	5	15	20
Age (mean = 34 years)			n
<18			12
18-24			1
25-34			8
35-44			8
45-54			4
55+			8

ATTENTION TO MEDIA COVERAGE AND PRIOR KNOWLEDGE

“Have you been keeping up with any of the news coverage of the Mars mission? If so, what in particular piqued your interest?”

The first interview question was intended to uncover whether visitors had paid attention to any of the media coverage that accompanied the summer 1997 Pathfinder mission and what, if anything, piqued their interest. Summaries of interviewee responses are given in Table II.2, with quotations from interviewees to follow.

Table II.2.

Attention to Media Coverage of the Mars Mission

Response	Teens <i>n</i>	Adults <i>n</i>	Total <i>n</i>
Yes	7	21	28
No	5	8	13

Adults

From the 21 adults who stated they had followed at least some of the media coverage of the Mars mission, there was a wide range of responses. Approximately one-half of adults talked about the mission in terms of its success. Among these responses, some interviewees described the Pathfinder's proper mechanical functioning and other technical accomplishments (see the first quotation below). As the second quotation below shows, some interviewees described the technical difficulties that were encountered and overcome.

I think that it's amazing how they did that—how they landed that thing [Pathfinder] within the target. I mean within so many cubic feet, or whatever, and it's so far away. They hit their target and I think that's pretty awesome.

It was pretty exciting. There was the bit when communications were failing between ground and the Pathfinder and it really looked like they were learning how to steer from the ground—this thing that is so many lightyears away [laugh]. So the fact that there were glitches that were then resolved, that's what I remember.

A few adults discussed activities of the Sojourner in very general terms. Their comments lacked detail and did not place the rover's activities in any context, such as its meaning, purpose, or success (see the quotations below).

We sent the Pathfinder there, and then the rover ran around and looked at rocks. I'm not sure what it all means.

I think I was most interested in the technology and how the rover was designed and, you know, demonstrations of how it actually maneuvered on Mars.

Two individuals expressed their disappointment that nothing “earthshaking” or relevant to lay people resulted from the mission, such as answers to questions about life on Mars or any of the other “big questions.” One individual commented on the uniqueness of the Pathfinder images, calling them “different [from] any of the other pictures of Mars” because they were “real close up and you could see mountains.” Another interviewee found the mission interesting because “it was live, and we hadn't done it before, and it was new.”

About one-quarter of adults stated they did not pay attention to the Pathfinder mission. When asked why the mission did not capture their attention, interviewees gave a number of different reasons, including vacationing outside the United States during the summer coverage, lacking time, not following current events in general, watching baseball games instead, and living outside the United States (Canada and England).

Teens

Although about one-half of the teens also stated they had followed at least some of the Pathfinder mission, the variety of responses to the question of what piqued their interest differed greatly from the responses of adults. In general, teens' responses fell into two categories: they either lacked detail and merely stated the existence of a Mars mission (see the first quotation below), or they mentioned specific activities associated with the Sojourner rover (see the second quotation below). Five teens stated they did not pay attention to the Pathfinder mission. Although all these teens were either currently studying Mars in school or had during the previous school year, none specifically mentioned the Pathfinder mission in response to the initial question or throughout the rest of the interview. Only two teens talked specifically about a rover (see the last quotation below), and none of the teens referred to the Pathfinder or the Sojourner by name. Also, none of the teens discussed the mission's purpose, findings, or pending questions, as did most of the adults.

I like the idea of the scientists' building something and sending it to Mars. I'd like to do that some day.

The stuff about the naming the rocks after cartoon [characters]—that's silly. (Why is that silly?) Grown-ups choosing cartoon names for the rocks is silly!

[What was interesting to me was] how the rover was driving around on Mars and the pictures the were sent back to Earth.

OBJECTIVE AND PERSONAL MEANING OF THE MARS MISSION

"What meaning, if any, would you say the Mars exploration has for you?"

Interviewees were asked if they drew any meaning from the Mars mission. Follow-up questions were used to distinguish between objective and personal meaning.

Adults

Most adults viewed the Mars mission as having meaning to the United States and to scientific progress in general. Some individuals mentioned the mission's importance in and of itself (see the first quotation below), while others focused on ideas of progress (see the second quotation below), and still others intertwined the two ideas (see the last quotation below).

I don't think the relevance is clear, but I suppose it's a matter of pride. (Matter of pride?) Yes, for America—that what we set out to do we did and did it well. It's another feather in our cap.

I guess it's about progress. Things happen so fast now. Sometimes it makes me feel like my kids will see a totally different world than the one I grew up in. (How is it about progress?) It seems like we can do more and more things each year—like explore Mars up close like they did this summer or clone sheep. I mean, it's amazing!

[The Mars mission had meaning] not on a personal level, but for NASA or the country I guess. It's like another milestone in space exploration that's been reached. (What do you mean?) I think they are going to be going back, so it was a first step to try some things out and see if they worked for next time.

About one-quarter of the interviewees did not discuss meaning but rather talked about the importance of the Pathfinder mission. Some interviewees said the mission was “important” but that it did not have any particular meaning to them or “relevance in day-to-day life.” These responses remained unchanged even after the question was rephrased to clarify “meaning” to include personal, patriotic, and scientific realms. A few interviewees made comments similar to ones made in response to the first question, which asked about what piqued their interest, by talking about the mission's success.

A few individuals found personal meaning in the Mars mission. All three said the mission had changed the way they felt about Mars and space exploration (see the quotation below).

To me it made Mars feel like a destination—like a place that we went to and could return to. I mean the pictures that Pathfinder was sending back were so detailed they almost made me feel like I'd been there myself. Just seeing the details of the surface made the exploration more personal for me.

In contrast, two individuals saw the Mars mission as having meaning not for them or the country, but only for scientists. The quotation below serves as a summary of their sentiments.

[The Mars mission did not have any meaning for me, but] for the scientists it must be meaningful because they know more about Mars to begin with, so any little bit of new knowledge is probably exciting. Also, they built the thing and they were invested in it—not like the rest of us. We are just bystanders. (That's really interesting, can you say a little more about that?) Well, we just watched for updates and things. We didn't have any control over the mission.

Teens

The responses from teens were very different from those made by adults. The most common response from teens was “I don’t know” and “I don’t think so.” Although the question was rephrased and follow-up questions were asked, one-quarter of the teens stated either that the mission did not have any meaning for them or they did not know its meaning. Instead of talking in terms of progress, as some adults did, three teens stated that there is “a lot more to learn” about Mars from missions like this past summer’s and future ones. Three other teens remarked that the Pathfinder mission was a historic event, as either “the first time we sent something to Mars,” the first rover to be used, or the first “successful landing on Mars in a long time.” One teen stated the mission was important to the United States as a source of national pride, and none of the teens found any personal meaning in the Mars mission.

VALUE OF EXPLORING MARS

Interviewees’ Perceptions of What Scientists Value

“Why do you think scientists are so excited about exploring Mars?”

After interviewees were told that scientists working on the Pathfinder mission are very excited about exploring Mars, they were asked to give possible reasons for the scientists’ reactions.

Adults

Most adults included in their response the idea that scientists are excited about exploring Mars because of professional interest. About one-quarter of adults simply stated that scientists’ excitement came from their work interests (see the first quotation below). Another quarter of adults combined the notion of professional identity with that of potential knowledge gain when explaining why scientists value the Mars mission (see the second quotation below).

[Scientists are so excited about exploring Mars because] it’s their job. I mean they got into the sciences probably because they loved it, and so it’s easy to be excited about something you love.

As scientists, I think they are anxious to look at the data Pathfinder gathered and see what it all means. Also I think part of the reason the mission took place at all was because of the excitement of scientists about the possibility of new information about Mars.

Some adults explicitly stated that they shared scientists’ excitement about exploring Mars. A few of these interviewees valued new information that could be gained in a Mars mission (see the quotation below), and two individuals took their enthusiasm one step further by stating they would gladly volunteer for a manned mission. Other interviewees gave a variety of reasons, including reiterating the success of Pathfinder, and talking about how exploration of anything new is exciting. One idiosyncratic response which emphasized the importance of exploring Mars because “it’s always been the planet that we suspected might be a problem—you know *War of the Worlds* kind of stuff.”

Well, I'm excited, too—looking for life on Mars is going to be one of the most important scientific endeavors of our time. Maybe I'm biased but it's really important for us to find out. It's a question we've been asking since people first saw planets in the sky: Are we alone? And I know it will probably be just microscopic life, but that's still thrilling.

Teens

Like the adults, many teens said that scientists are excited about exploring Mars because of their professional interests. Most teens simply stated that scientists' excitement comes from their well-developed knowledge base or stems from job duties (see the first quotation below). One teen took the idea a little further by expressing a shared enthusiasm and attaching historical significance to the Pathfinder mission (see the second quotation below).

[Exploring Mars is exciting for scientists because] they study that kind of stuff so they must like it a lot. They had to go to school for a long time even to be able to study it, so they know a lot already.

[Scientists are excited about exploring Mars and] part of it has to do with their being scientists, and it's their job. But I thought it was cool, too. I'm too young to have seen the moon landing, so my parents told me it's sort of like that for me. It's a big step in space exploration.

Two teens answered, "I don't know" to the question of why scientists are excited about the Mars mission as well as to subsequent probes. One teen stated, as two adults had, that it is exciting to "explore new places and find new things." Another teen was unable to answer the question about scientists' excitement but mentioned that exploring Mars was important. After a follow-up question, he explained that studying Mars is necessary because people might need to live on Mars should the world become overpopulated, or people may simply want to live there.

Interviewees' Personal Values

"What do you think is the value of exploring Mars?"

As follow-up to the question pertaining to scientists' excitement over Mars, interviewees were asked how they value the exploration of Mars. Follow-up questions were used to clarify whether respondents were talking about their values or scientists' values.

Adults

About three-fifths of adults commented on the inherent importance of learning and discovery. In fact, most interviewees strongly valued “pure exploration” and “discovery for discovery’s sake,” regardless of any benefit or outcome (see the first quotation below). A few interviewees, in addition to talking about the inherent value of exploration, made distinctions between the value of Mars exploration for lay people versus that for scientists (see the second quotation). Others valued not only pure exploration but also benefits that could come from exploring Mars. The last quotation below accurately summarizes this sentiment.

Well, I’m not sure there is a real practical value, yet maybe they’ll figure one out or find something, but even though it won’t affect our daily lives, we still have to do it. (Why is that?) It’s just human nature to study what we see. It’s like going to the moon. I don’t think everyday people benefited from that, but it was still important to go and explore it.

I guess for pure exploration. (Any other value?) I guess scientists value it for all the information they are getting, but there is no clear-cut value for the rest of us.

If we can find something we can use, like rare minerals or certain metals that we don’t have on this planet that could give us better strength, lighter—maybe manufacturing processes that use those materials. It takes a lot of money in order to find out these things. But I just think it’s important to keep the pursuit going, what the heck—we waste so much money now, why not spend some more money on pure science! It’s really worth it.

Other interviewees had a mixture of responses. Four interviewees focused on the idea of colonization. Some of these interviewees placed the value of exploring Mars on future colonization (see the first quotation), while others valued what the process of exploration could teach people about themselves (see the second quotation). Four other interviewees simply reiterated their interest in exploring Mars or remarked on its importance rather than talking specifically about value, even after being asked several follow-up questions. Two interviewees stated that the value of exploring Mars lay in searching for other life forms. They expressed surprise that life on Mars had yet to be found and emphasized the need for further study of Mars.

[The value of exploring Mars is] probably mostly economic and population-wise. If we don’t kill ourselves off, we’ll have too many [people] pretty soon. (So how does Mars figure into that?) Another place to go. Like the West of the United States a couple of centuries ago.

The whole reason to do this is . . . it could teach you a lot about yourself, and I don’t mean necessarily in any practical sense but more in a spiritual way. . . . (Can you say more about teaching us a lot about ourselves?) Well, I guess about where our spirit of exploration will take us and what are the implications for humankind if we do go to Mars and maybe some day colonize it. Maybe it will change our Earth-centric view; maybe it’s more philosophical than spiritual.

Teens

There is a striking contrast between teens' responses and those of adults. While adults had emphasized the value of pure exploration, many teens focused on applied learning. About half of the teens saw the value of exploring Mars in the new information that could be gained from further study (see the first quotation below). About one-third of the teens valued the new Mars information resulting from exploration not for its own sake but for application in planning future piloted missions or even colonization of Mars (see the second quotation). Three teens made remarks similar to those of adults by stating the value of pure exploration and learning.

[The value of exploring Mars is] to find out what's there—to see for sure what rocks are made of, how big the mountains are—that kind of stuff. (What do you mean find out for sure?) I think before this they were using old information or information they got from satellites and things that just orbited Mars, [that did] not actually land there.

I guess we just need to know more about this planet that is so close to Earth—especially if we want to send people there. (Send people there?) Like the manned space mission—like landing on the moon.

FAMILIARITY WITH MARS TOPICS

“From this list of Mars topics, which of these, if any, would you feel comfortable talking about?”

Interviewees were shown a list of six Mars topics: Martian climate/weather/atmosphere, Martian landscapes, Mars in movies and TV, presence of liquid water on Mars, Mars in science fiction, and possible life on Mars. Interviewees were then asked to talk about any of the topics with which they felt comfortable. Follow-up questions were used to encourage interviewees to discuss the topics they chose.

Adults

Almost all of the respondents referred to the “recent mission,” meaning the Pathfinder mission, in their responses. In fact, several interviewees did not select a topic from the list but rather acknowledged the existence of the Pathfinder mission (see the first quotation below) or mentioned a few anecdotes from the mission such as rocks being named after cartoon characters. Some interviewees chose “Martian landscapes” from the list of Mars topics and talked about them in the context of the Pathfinder mission (see the second quotation below). When talking about the landscape and Pathfinder's activities, some interviewees also mentioned the possibility of water and life on Mars (see the third quotation).

I don't really know anything about Mars itself—just that this summer we had the mission [to Mars].

[From the list of Mars topics, I would choose the] landscape one. It's very varied. There are valleys, mountains, volcanoes, ancient river beds. This made it hard to choose a landing site for Pathfinder.

I think [I feel comfortable talking about] the landscape. That's interesting. When I see it, it looks a lot like our deserts—a good reason to believe that there has been life—still could be life—on Mars. I'd also be interested in finding out if there is water on Mars. Did [Pathfinder] discover anything about water on Mars? That would be interesting to find out. If there is water, there certainly could be life.

Some interviewees chose to talk about life on Mars, aliens, or science fiction. Three individuals were concerned only with the search for possible life on Mars. All of them stated that the Pathfinder mission was looking for life on Mars and that nothing “conclusive” had been found. One of these interviewees also mentioned the Martian meteorite and how scientists are still trying to determine if it contains “evidence of ancient life on Mars.” Two other interviewees talked about aliens. One spoke briefly about the rover and joked about Martians but, after follow-up questions, did not choose to expound further on this topic. The other talked about possible life on Mars in the context of the “stories that people tell” about aliens and clearly stated that popular discussion about aliens is “not really about Mars so much as about just aliens in general.” Another individual talked about the Pathfinder pictures and her love of the *Star Wars* trilogy and the *Star Trek* series but was quick to point out that those science fiction works dealt mainly with other galaxies and not Mars.

Five individuals stated that they did not feel comfortable talking about any of the Mars topics. Not surprisingly, three of these interviewees stated earlier that they did not follow the Pathfinder mission. The other two stated they had followed the mission, but, unlike other interviewees, may have been reluctant to talk about topics not on the list presented to them.

Teens

In contrast with the adults, all the teens attempted to respond to the list of Mars topics. Also, while almost all the adults discussed the Mars topics in the context of the Pathfinder mission, most teens discussed the Mars topics in light of information learned at school. Interviewees who referred to school often talked about Mars in terms of textbooklike facts (see the first and second quotations below). One teen combined what he had learned in school with popular notions of aliens (see the third quotation), while another combined school knowledge with a brief mention of Pathfinder (see the last quotation).

I don't remember what we talked about in school except I think they call Mars the red planet because the dirt there is red. I think it's really hot there.

Sometimes it can be up to 10 degrees up there and that the lowest temperature is negative 200 degrees. And that scientists don't know that much about Mars because of all the dust that's in the atmosphere—it kind of hides what's going on. And I think there are a lot of mountains, volcanoes, and canyons on Mars and that there was once water on Mars, but not any more. (Wow, you know a lot about Mars. Where did you learn all of this?) In school, and I have a *Magic School Bus* CD ROM at home.

My teacher told us that Mars has a weak atmosphere—that there isn't much air there, and if people went there they wouldn't be able to breathe—they'd have to take oxygen with them. (What else do you know about that?) Well, Mars is really different [from] Earth. It doesn't have any oxygen, and it's really windy and hot. (Anything else?) Well, I

know about aliens—you know people always talk about aliens—my aunt says that in the Bermuda Triangle there are aliens that drag people under water and test them and stuff. (You know, I've heard that, too. What do you think about that?) That's just what my Aunt says.

I don't remember if they found out some of this [referring to the list of Mars topics] from the last mission. I guess I know old information from school. (Like what?) That Mars is a cold desert and has no atmosphere.

Four other teens also mentioned the Pathfinder mission. Two stated facts about the Martian landscape that they had gleaned from the mission (see the first quotation below). One teen spoke briefly of the Pathfinder pictures and upon further questioning also credited television for some of his impressions of aliens (see the second quotation). Only one teen talked about the issues directly related to the Pathfinder mission: possible life and water on Mars (see the last quotation).

[I can talk about] Mars landscape. Well, Mars has mountains and stuff that made it hard [for Pathfinder] to land there. It's real dry there.

[I could talk about the] Martian landscape—I saw the pictures [from the Pathfinder] so I have some idea of what Mars looks like, but that's about it. (Anything else about the other topics? What about Mars in movies and TV?) I mean there's a lot about aliens, but not from Mars—they're all from outside our solar system—like far away.

[I've heard about] possible life on Mars and maybe water on Mars. (What about those two topics?) Well, it would be pretty interesting to find out if there is or was life and water is connected to that. (How is water connected to life?) You need water for there to be life—I think I read that in a magazine about the mission.

Two teens had idiosyncratic responses. One teen did not refer to school or the Pathfinder mission. Instead, she talked about Mars within the context of Mars in movies and TV. Her comment appears below. The other teen did not choose a Mars topic from the set list but rather talked about the colonization of Mars and how scientists would have to “fix the temperature and move everything from the Earth up there so people could live there.”

I know a little about life on Mars. I believe that there is life on Mars because I've been hearing about aliens and stuff. (What about aliens?) There are stories about ugly red and green ones, but not from Mars. (Where are they from?) Well, they are just in stories, but it's fun to think about them. (There have been a couple of movies about aliens—have you seen any of them?) I saw *Mars Attacks!* They had these ugly aliens and when they heard this yodeling sound their heads would explode. [laughter] But that wasn't really about Mars.

IMAGES OF MARS

Interviewees were shown three pictures of Mars labeled A, B, and C: (A) whole planet image taken by Viking Orbiter 1, (B) artist's rendition of a dust storm on Mars, and (C) image made by

Pathfinder of the Martian landscape with the Sojourner rover (see Appendix C). Interviewees were then asked which image they found the most appealing and the least appealing and why. Summaries of images selected by interviewees are given in Table II.3 for the most appealing image and Table II.4 for the least appealing image. Interviewee comments follow each table.

Most Appealing Images of Mars

“Of these three pictures of Mars, which one is the most appealing? Why?”

As Table II.3 shows, adults and teens, in general, had contrasting opinions about the landscape with Sojourner and the artist’s rendition of a dust storm. About four-fifths of adults found the landscape with Sojourner to be the most appealing image, while one-quarter liked the artist’s rendition. Three-quarters of the teens chose the artist’s rendition, while four teens found the landscape with Sojourner to be the most appealing. As a group, neither the adults nor the teens found the whole planet image to be very compelling.

Table II.3.
Most Appealing Mars Image (n = 41)

Image	Adults (n = 29) n¹	Teens (n = 12) n¹	Total (n = 41) n¹
Martian landscape with Sojourner	23	4	27
Artist’s rendition of a dust storm on Mars	7	9	16
Whole planet image taken by Viking Orbiter 1	5	3	8

¹Because some interviewees chose more than one image, column totals exceed n.

Adults - Landscape with Sojourner

Most adults gave a combination of reasons for choosing the landscape with Sojourner as the most appealing image. Interviewees commented on the image’s detailed nature, authenticity, novelty, sense of scale, inclusion of Sojourner as a human presence on Mars, and similarity in appearance to Earth. The quotations below give a sample of the responses.

[The landscape with Sojourner is the most appealing because it] looks like what I would imagine Mars would look like. It’s very precise looking, very detailed, current, and it’s good because it has the Pathfinder and Sojourner in it. The skyline, horizon is interesting and it, with the rover, gives you a sense of scale. I mean I’m not exactly sure what the sizes are, but I have at least some idea.

I guess [the landscape with Sojourner is the most appealing] because there’s something there that’s ours. (Meaning?) Pathfinder and Sojourner and seeing an image of the two on Mars is pretty exciting. Like I said, because it shows humans, us, up there. It also looks like home. I’m from Las Vegas, Nevada, and it looks like home—the desert.

I'd pick [the landscape with Sojourner as the most appealing picture of Mars]. It's the real thing—like a photo.

I'd pick [the landscape with Sojourner as the most appealing]. Even though I've seen it a lot—it's still a new view of what Mars looks like. (What do you mean?) Well, very close up. I don't remember seeing such close-up pictures of Mars before this last mission.

Adults - Other Responses

Four adults chose the artist's rendition of a dust storm on Mars as the most appealing image because of its "fantastic," "out-of-this-world," and "science fiction-like" qualities. Two adults chose the whole planet image of Mars for its rendering of the planet's surface and intriguing polar ice caps. Two other individuals stated they liked all three of the images, because they saw them as a sequence starting with the whole planet image and getting progressively more detailed.

Teens - Artist's Rendition of a Dust Storm

Three-fourths of the teens chose the artist's rendition of a dust storm on Mars as the most appealing image. Most of the teens said they liked the "bright colors" and "action" of the picture (see the first quotation below). Two teens chose the dust storm image because it "looks like Mars" (see the second quotation).

I like the colors and the way it looks like it's about to begin to storm. Stuff looks like it's moving, like in a movie, and that makes it more interesting.

[I'd choose the dust storm picture as the most appealing] because I like storms on Mars. There's a lot of gas and fire—it sort of looks like a tsunami that goes around and destroys everything in its path. (Do you like anything else about this picture?) Well, it looks like Mars. It's hot, and there's a lot of wind and dust.

Teens - Other Responses

A few teens did not explain their choice for most appealing image but rather reiterated that the images were "nice to look at." The two teens who chose the landscape with Sojourner image as the most appealing were familiar with the Mars mission and liked this picture, in particular, because it showed a close-up view of the rover.

Least Appealing Image of Mars

"Of these three pictures of Mars, which is the least appealing, and why?"

After interviewees identified the most appealing image of Mars and explained their selection, they were asked to look at the same three images, choose the one they found to be the least appealing, and explain why. Summaries of the images selected by interviewees are given in Table II.4, with interviewee comments to follow.

As seen in Table II.4, opinions about the least appealing image differed greatly between adults and teens. Two-thirds of the adults chose the artist’s rendition as the least appealing image, whereas only one teen did so. More than one-quarter of the adults felt negatively about the whole planet image, whereas again only one teen chose it as the least appealing. Half of the teens found the landscape with Sojourner to be the least appealing, while this same image was overwhelmingly popular with the adults. A few interviewees, particularly teens, were unwilling to choose a least favorite image, an outcome that is most likely owing to courtesy bias (when respondents choose pleasing comments so as not to hurt others [Warwich and Lininger, 1975]).

Table II.4.
Least Appealing Mars Image (n=41)

Image	Adults (n = 29) n¹	Teens (n = 12) n	Total (n = 41) n¹
Artist’s rendition of a dust storm on Mars	20	1	21
Martian landscape with Sojourner	3	6	9
Whole planet image taken by Viking Orbiter 1	8	1	9
None of the three images	2	4	6

¹Because some interviewees chose more than one image, column totals exceed n.

Adults - Artist’s Rendition of a Dust Storm

Two-thirds of adults chose the artist’s rendition of a dust storm on Mars as the least appealing image. Most interviewees disliked the artist’s rendition because they questioned its accuracy (see the first quotation below) or found its style to be too unrealistic (see the second quotation below). Adults often compared the artist’s rendition to the other images and valued the whole planet image and landscape with Sojourner because they “look real like a photograph.” A few interviewees disliked the artist’s rendition because they did not understand what it was trying to portray (see the third quotation below), while others objected to its “violent” nature and “fire and brimstone” quality.

[The artist’s rendition] looks like a drawing or something, and I’m not sure how accurate it is. I don’t think we know enough about Mars to make these kinds of pictures.

[The artist’s rendition] doesn’t look real. It looks like a backdrop of a B-grade movie. (In what ways?) The colors, the cotton ball-like clouds, the sense of impending doom and destruction.

[To me, the least appealing image is the artist’s rendition.] I can’t tell what kind of view it is—you know like bird’s-eye or what, and I guess it’s supposed to be Mars, but the coloring is all wrong or just not realistic. (And why do you think that’s unappealing?) I guess because I’m not sure what the picture is or is about. Maybe if I knew, I’d like it more. (It’s an artist’s rendition of a dust storm on Mars.) Well, I’d then question what it is based on because it looks pretty imaginative. [laugh]

Adults - Other Responses

Eight interviewees chose the whole planet image taken by Viking Orbiter 1 as the least appealing picture. Some adults disliked the image because pictures of planets from space are “so commonplace nowadays that they have lost their appeal.” Other adults said the whole planet image did not look distinctly like Mars and instead reminded them of the moon. Three adults found the landscape with Sojourner to be the least appealing image because it “just looks like a bunch of rocks.” One individual also said that he had seen too many Pathfinder images over the summer and was tired of them.

Teens - Landscape with Sojourner

Half of the teens found the landscape with Sojourner to be the least appealing image. Two stated that the Sojourner image “doesn’t look like Mars” (see the quotation below). Two teens did not like the Sojourner image because it “looks boring” and “doesn’t have any action.” The other two teens who did not like the Sojourner image had idiosyncratic reasons. One teen said that she did not like the image because “there are too many little rocks” and that she “[doesn’t] like rocks that much.” She also added that she did not like seeing “trash” on Mars [referring to the Pathfinder]. The other teen did not like seeing the edge of Pathfinder in the picture because she did not know what it was.

[The landscape with Sojourner] is just dirt and rocks. It doesn’t look real—it doesn’t look like I imagined Mars would look. (How did you imagine Mars would look like?) Really red and hot with lots of wind and mountains and volcanoes and valleys—not flat like in [the Sojourner image].

Teens - Other Responses

Two teens made comments similar to those made by adults. One teen found the whole planet image to be the least appealing because it lacked details and looked “like the moon.” Another did not like the artist’s rendition of a dust storm, stating that it did not “look real.”

MARS AS A REAL PLACE

Reasons Mars Is a Real Place

“What does the phrase, ‘Mars is a real place,’ mean to you?”

Interviewees were told that to scientists Mars is a real place and were then asked to explain how Mars is a real place.

Adults

Most adults said that Mars is a real place because people can scientifically study it, send human-made machines there, and see images of it (see the first quotation below). In addition to the study of Mars and existence of images as reasons for Mars being a real place, some interviewees added that Mars is real because it looks like Earth (see the second quotation below). Other interviewees emphasized that Mars is a real place to scientists (see the third quotation). A few

individuals focused on sight, stating that Mars is a real place because one can see it “up in the sky” or “through a telescope.”

Well, you just know [Mars] is there. I mean I’ve never been to the West Coast but I know it’s there. We’ve seen the pictures, read about it, and in this last mission we landed there.

We’ve been studying Mars for a while and have pictures of it, but Mars is real to me because in this picture [referring to the landscape with Sojourner] it looks like a rock-strewn desert, you know, something we have here [on Earth].

Scientists know what the atmosphere is like as far as scientific findings—maybe that makes it real to them—knowing all the facts about it. When people just peer up at the sky, it’s not really real. It’s just the sky—like the man in the moon [laugh].

Teens

As the following quotations demonstrate, most teens did not explain how Mars is a real place but rather reaffirmed the existence of Mars.

[Mars] is real. It’s a planet in the solar system—everybody knows that.

[Mars] is a place that really exists. It isn’t made up or a fairy tale.

A few teens stated that Mars is a real place because “we can see pictures of it” and “see it in the sky at night.” A few other teens stated that Mars is a real place for scientists because they study it, and it is real for teens because they learn about it in school. One teen echoed a sentiment made by some of the adults, saying that Mars is a real place because human-made craft have landed there.

Images That Make Mars Feel Like a Real Place

“Do any of these three pictures make Mars feel like a real place to you? How so?”

Interviewees were asked whether any of the images shown earlier in the interview (whole planet image, artist’s rendition of a dust storm, and landscape with Sojourner) makes Mars feel like a real place. Follow-up questions helped interviewees identify what exactly in the pictures gave Mars a sense of reality. Summaries of the images selected by interviewees are given in Table II.5, with interviewee comments to follow.

As Table II.5 shows, almost all of the adults and one-half of teens chose the landscape with Sojourner as the picture that made Mars feel like a real place. Interviewees’ choices for the most appealing image and one that makes Mars a real place did not always correspond. This is most dramatic among the teens as many of them chose the artist’s rendition of a dust storm as the most appealing image, but only three said it made Mars feel like a real place.

Table II.5.
Image That Makes Mars Feel Like a Real Place ($n = 41$)

Image	Adults ($n = 29$) n^1	Teens ($n = 12$) n^1	Total ($n = 41$) n^1
Martian landscape with Sojourner	27	6	33
Whole planet image taken by Viking Orbiter 1	3	4	7
Artist’s rendition of a dust storm on Mars	0	3	3
None of the images	1	1	2

¹Because some interviewees chose more than one image, column totals exceed n .

Adults

Most of the adults who chose the Sojourner image talked about how the presence of Pathfinder and the rover made Mars feel real to them. Often they spoke simply of the presence of the probes (see the first quotation below), and in a few cases they talked about how showing the rover in the landscape gave a sense of scale (see the second and third quotations). A few other interviewees did not point to specific elements in the Sojourner image but rather talked about the image being “the real thing,” meaning an image taken by a camera, which in and of itself made Mars feel real to them.

[The Sojourner image makes Mars feel real] because you can see the rover, the rocks, and the rover’s tracks. We were there. We’ve changed the landscape forever by our presence. (What do you mean?) Well, the rover isn’t going anywhere [laugh].

[The Sojourner image makes Mars feel real] because it shows the horizon and yet it shows part of the last probe and the rover so you could compare those sizes and get an idea of how big that rock is.

[Mars feels like a real place in the Sojourner image] because you can actually see the rocks and the details. I feel like I could pick up one of those rocks and hold it in my hand or walk on out into the scene. . . . It really does give you the feeling that you could pick that rock up, and anything you can pick up and hold [is] more real to you.

Teens

The teens had disparate opinions about which image made Mars feel like a real place. One-half of the teens stated that the landscape with Sojourner image made Mars feel like a real place to them. Two of these teens mentioned how the presence of the “ship we sent” and familiar land forms, such as mountains, made Mars feel real to them. One individual said the Sojourner image made Mars feel like a real place because the image was “close-up, like you could walk out onto it,” while another noted that it was the “best picture—like someone took it with a camera.”

Two teens chose the whole planet image because “[Mars] is a planet when you see pictures like this—that show the whole thing.” Two other teens thought the feeling of “approaching from space” that the whole planet image creates and the action portrayed in the artist’s rendition made Mars feel real to them.

Exhibits That Would Make Mars Feel Like a Real Place

“What should be included in the exhibition to make Mars feel real to you?”

Interviewees were told that an exhibition about Mars was being planned and that one of the goals of the exhibition was to make Mars feel like a real place. They were then asked what should be included in the exhibition to fulfill this goal.

Adults

About one-third of the adults said the exhibition being planned should make visitors feel like they are visiting Mars. Most of these interviewees suggested that the exhibition contain a mock Mars environment that captures the physical nature of the Martian landscape (see the first quotation). Others wanted to have the experience of traveling to Mars (see the second quotation below) or colonizing the planet recreated in the exhibition (see the third and fourth quotations).

It would be wonderful to be able to walk through a reconstruction of the surface, the landscape similar to [the Sojourner image]. You could take that concept and make it real by letting people walk past the rover and see its tracks and the rocks and get a sense of the size of things. Give people a sense of being there and show that we’ve been there through the rover.

We just came off of the space lab [in an exhibition at NASM], and that was pretty real feeling. So maybe you could have something where you have the perspective of being on Mars and you look and you see Earth from Mars or a space ship traveling to Mars. Or

maybe if you were on Earth at mission control and you had to send signals to control the rover from far away—to simulate what it was really like to do this.

I guess the best thing [to make visitors feel like Mars is a real place] is to make them feel like they are a space explorer walking on Mars, staying in space dwellings—maybe simulate how heavy the gear would be that you'd have to wear on Mars or maybe virtual reality or 3-D movie kinds of things.

I think to be a real place—a place where people could exist and kind of make a life there—you'd need people. [Showing] more about colonizing [Mars] and learning how to live there, like growing food and building structures is important.

Some adults felt that including a working replica of the rover would make Mars feel real to visitors, while others wanted to see and possibly touch rocks and other artifacts from Mars. A few interviewees, who were quite knowledgeable about Mars, thought including information about the mission's scientists and “what goes on behind the scenes” would help make Mars feel more like a real place (see the quotations below).

[I was] just thinking about [Carl] Sagan. I mean, he loved his work and you could tell. So I think the excitement of the people has to come through also, or it will be like a boring documentary. (Like what the scientists felt during the mission?) Yeah, like what they felt during the mission. Because that was a major thing for them. I think other people are interested in personal opinions more than the information itself, and I think the personal information needs to come from the people actually doing the work. . . . I think passion means a lot in any exhibit.

It would be really great if you could have a person in [the exhibition] who would be able to talk to people, because I think that would have a much greater emotional impact on people—help them connect to Mars. I think it is also really important to give people a real sense of the people who are doing the work. People don't know—or have a certain view of scientists. I mean these scientists are so lucky, and I think people should be told how the scientists got to where they are today. There isn't a clear-cut path, and kids who want to become space explorers need to know how they can do this.

Others suggested using pictures like the Sojourner image, making comparisons between the sizes of land features on Mars with those on Earth, regularly posting new information and images as they become available, and relating information about Mars to people's lives. Two interviewees expressed concern that people who do not think Mars is a real place would not be convinced by an exhibition, regardless of what it contained.

Teens

Like the adults, many teens suggested that the exhibition being planned include simulations of the Martian environment or of space travel. Two quotations are given below to demonstrate these ideas.

Maybe [the exhibition could] have a little platform and have rocks [so] it looks like you're walking on Mars.

Maybe [the exhibition could] have a space ship that you could sit in and control—act like you're on your way to Mars. Maybe show videos of Mars so it feels like you're about to land there.

A few teens also suggested having a model of the rover that people could touch and showing the most current information and pictures from missions. Three teens talked more generally about exhibition ideas, suggesting that it include pictures of Mars, “games and stuff kids can do,” computers, IMAX films, movies, “papers that people can take home with them to remember Mars,” artifacts to touch, and “stuff just to look at.”

INTERPRETIVE STRATEGY

“Here are three different ways to present information about Mars. Which one of these three do you prefer? Why?”

Interviewees were shown the same picture of Olympus Mons (see Appendix D) with three different captions (see Table II. 6 below) to test three different interpretive strategies: Mars/Earth comparison, Mars/solar system comparison, and explore Mars scenario. Interviewees were then asked to pick the caption that explained the information in the clearest manner. Summaries of the interpretive strategies selected by interviewees are given in Table II.6, with interviewees' comments to follow.

As Table II.6 shows, almost one-half of the adults and two-thirds of the teens chose the Mars/solar system comparison as the best way to present information about Mars. The Mars/Earth comparison was more popular with adults than teens, as three-fifths of the adults chose this interpretive strategy while only two teens selected it. The explore Mars scenario was not popular with either adults or teens.

Table II.6.
Most Appealing Interpretive Strategies (n = 41)

Interpretive Strategy	Caption	Adults (n = 29) n¹	Teen (n = 12) n	Total (n = 41) n¹
Mars/solar system comparison	At 79,000 ft. tall, Olympus Mons is the largest known volcano in the solar system.	13	8	21
Mars/Earth comparison	Olympus Mons is the largest Martian volcano, with a base the size of Texas.	18	2	20
Explore Mars scenario	Using radar, scientists have discovered Olympus Mons is 79,000 ft tall.	3	2	5

¹Because some interviewees chose more than one image, column totals exceed n.

Adults

Most adults chose the Mars/Earth comparison as the best way to convey information about Mars. All of the interviewees who preferred the Mars/Earth comparison appreciated having a familiar Earth feature with which to compare the Martian one (see the quotation below).

I like the one with Texas [Mars/Earth comparison], because the size of Texas is something I can relate to. The [Mars/solar system comparison] with the 79,000 feet, even though I am an engineer, is hard to really understand.

Several of the interviewees chose the Mars/solar system comparison as the best interpretive strategy because it was easy to read, not specific to the United States, and provided both a descriptive comparison and the height in feet (see the quotations below).

The one about the solar system gives you more information. I like that it gives you the number [of feet for the height] and gives you a comparison. The others give you one or the other.

[The Mars/solar system comparison is the best caption because] it gives you something to compare it to. I mean the one with Texas [referring to the Earth/Mars comparison] would be good, but I'm from England so I don't know how big Texas is, so it's not too helpful. I'd rather have the measurement like this one.

Two interviewees preferred the explore Mars scenario. One liked hearing about how scientists study Mars, and the other thought the explore Mars caption was the most clearly written of the three. One individual did not like any of the captions and thought the comparisons should not be United States specific and that the height should be compared graphically with Mount Everest or skyscrapers.

Teens

In contrast with adults, most teens chose the Mars/solar system comparison as the best way to present information about Mars. As the quotation below shows, teens thought the Mars/solar system caption gave more information than the other two and were highly impressed with learning that Olympus Mons is the largest volcano in the known solar system.

The [Mars/solar system comparison] is just clearer. It gives you more information than the other two. (What kind of information do you like?) The part where it tells you how big [Olympus Mons] is and compares it with the rest of the solar system. (Why is that important?) Well, now you know that it's the biggest, and that's really interesting.

Two teens chose the Earth/Mars comparison as the most effective interpretive strategy because of the reference to the size of Texas (see the quotation below). Two other teens preferred the explore Mars scenario because they liked learning that radar was used to determine the height of the volcano.

[I like] the one that has Texas, because people can relate to Texas because most people who come from the United States know how large Texas is and have seen it on maps and [can] picture how big it is in their minds.

OTHER INTERVIEWEE COMMENTS AND SUGGESTIONS

“Would you like to say anything else about Mars or the exhibition being planned?”

The final question allowed respondents to make additional comments and suggestions. This section includes not only these remarks but also other insightful comments interviewees made throughout the course of the interview that did not fit the line of questioning. Because interviews are conversational in nature, interviewees are encouraged to give highly personal responses, and sometimes their remarks do not answer the question at hand but are still noteworthy. All of the quotations below are from adult interviewees.

While most adults did not have any additional comments they wanted to make, several asked questions or talked about the future of Mars exploration (see the quotations below).

Are they going to send a person? Are they going to be colonizing there?

I keep wondering about the future and plans [for] getting to Mars, [like] missions that are already planned and maybe possible scenarios on how manned missions will be undertaken.

I'm concerned because [the Pathfinder mission] was so successful using robotics, you know unmanned, that this might be emphasized and that bothers me because I think the priority should be to get people onto Mars, and because I want to go [laugh]. No, I would say it bothers me—machines can't do everything. . . . No matter how much you can identify with machines, I think it's a lot easier if you have a real person there seeing and testing. I mean, you've got to try manned missions.

I think it's a good project [referring to the Pathfinder], but they need to go further and check things out. Try to find some caves and other mountains.

Four interviewees gave suggestions about what should be included in the Mars exhibition. Quotations from all of these individuals are presented below, with the first two quotations from the same person and the other three from different interviewees.

If you could get some kind of graphically enhanced program to show volcanic eruptions and early stages of Mars's development, that would really capture the interest of the people. Some kind of movie—they like to see blood and guts and motion and things like that. I was in advertising for years so I think that would pique [visitors'] interest if nothing else. If I had to make an exhibit, I would lean towards more of the lava and fire and brimstone aspects, destroying asteroid, anything moving—nothing static. Making those computer enhanced animations is expensive, but I think money well spent.

If you could give people some relevance—let them know where our planet is situated and where Mars is and then bring [visitors] through that voyage through space . . . and then give a timeline comparison to Earth—like formation and appearance of life and all. It is mind boggling the kinds of time frames they talk about with the planets, and I don't think people have any comparisons. They talk in millions of years development, and I have no comparison. It's hard for me to think in fifty-year time frames. So it's even harder to get a sense of millions of years and where you are in time. Makes you feel insignificant.

I think the science fiction and TV connection to Mars [are] overdone. I mean, I'm a doctor but also a science journalist, and I think people need good, simple writing and clear facts rather than some tie-in to popular culture.

I think you should make ties to what's affecting people's lives and on their minds. Like I guess with the meteorite that they found maybe has fossil bacteria in it or something—you could tie it into current interest in bacteria, especially now with the problem of *E. coli*. Bacteria might be in people's minds, so that might make it real to them in the exhibit.

I want a video of what the scientists are seeing [on Mars], and I like movies where you listen to it rather than having to read it [laugh]. I don't want to read any more stuff.

As the following quotations demonstrate, a few respondents also thought that the *Where Next, Columbus?* exhibition was a good model for how to display the Martian environment and human colonization in an exhibition.

I don't think they could do a better job [referring to the *Where Next, Columbus?* exhibition]. With the atmosphere they create with the simulated rocks and light. It really makes you feel like you are on Mars. It's wonderful the way it makes you feel. My children really liked the [computer game] in *Where Next, Columbus?* where they designed the rover by putting on different legs and gear. They did the whole computer program like twenty minutes or longer. They liked being able to test their own ideas and pretend they were the scientists.

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