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**Master Thesis in Science Communication**


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# Examining Visitor Attitudes and Motivations at a Space Science Centre


**HDa-SC-04**

# Contents

## Abstract

The H.R. MacMillan Space Centre is a multi-faceted organization whose mission is to educate, inspire and evoke a sense of wonder about the universe, our planet and space exploration. As a popular, Vancouver science centre, it faces the same range of challenges and issues as other major attractions: how does the Space Centre maintain a healthy public attendance in an increasingly competitive market where visitors continue to be presented with an increasingly rich range of choices for their leisure spending and entertainment dollars? This front-end study investigated visitor attitudes, thoughts and preconceptions on the topic of space and astronomy. It also examined visitors' motivations for coming to a space science centre. Useful insights were obtained which will be applied to improve future programme content and exhibit development.

**Keywords:** space centre, planetarium, museum, visitor agendas, space science, astronomy, front end studies, visitor motivations, constructivism, free-choice learning, audience research.

# 1. Introduction

## 1.1 The Project

*Examining Visitor Attitudes and Motivations at a Space Science Centre* is a study, which took place at the H.R. MacMillan Space Centre, in Vancouver, Canada during May-June of 2004.

The H.R. MacMillan Space Centre is one of 3 large scale science centres in the city of Vancouver. The centre was effectively created in 1997 as the result of a major facility expansion project centred on the pre-existing H.R. MacMillan Planetarium.
To summarize, the aims of this study were to investigate:

- the assumptions, studies and conclusions that were made regarding visitor attitudes during the planning phase of a major facility expansion project commenced in 1997
- the public's current motivations for visiting the H.R. MacMillan Space Centre
- visitor attitudes and feelings towards space science and astronomy
- visitors' existing factual knowledge of space and the universe

Results of this investigation will be presented to H.R. MacMillan Space Centre senior staff and stakeholders in order to support more effective facility planning, programming and decision-making, enabling the provision of more effective programs and services. This will also be an opportunity to evaluate some of the key decisions and judgements incorporated into the 1997 expansion and to verify their validity.

## 1.2 Acknowledgements

I would like to thank the staff of the H.R. MacMillan Space Centre for their support, suggestions and general help during the preparation and implementation of this project. Special thanks in particular must go to my supervisor, Donna Livingstone, Managing Director of the H.R. MacMillan Space Centre. I am also indebted to my husband, David Marsh for his valuable advice and support throughout this work.

I would also like to thank the International Planetarium Society (IPS) for awarding me with the annual Spitz fund for Masters of Science Communication students.

## 1.3 The H.R. MacMillan Space Centre

The H.R. MacMillan Space Centre is a multi-faceted organization whose mission is to educate, inspire and evoke a sense of wonder about the universe, our planet and space exploration.

Prior to 1997, the *H.R.MacMillan Planetarium* was just that; a stand-alone planetarium facing the same kinds of issues a challenges as other planetaria and major attractions worldwide. As the public was presented with an increasingly rich range of choices for their leisure spending, maintaining healthy public attendance in an increasingly competitive market became a serious challenge. This raised the crucial question: could the Planetarium as a stand-alone facility survive?

After lengthy consultation with numerous parties, including politicians and attraction consultants, the decision was made to expand and upgrade the aging facility, resulting in the creation of the modern H.R. MacMillan Space Centre.

The facility today consists of a variety of thematic programming areas including (see Appendix A for photos):

- the Planetarium Star Theatre; a 240 seat domed multimedia theatre with a Zeiss (Jena) Universal Planetarium Star Projector
- the GroundStation Canada Theatre; a 90 seat stage multimedia theatre where staff deliver live science demonstrations on a number of space and astronomy related topics
- the Cosmic Courtyard; a 300 square metres interactive exhibit gallery
- a SimEx Virtual Voyages Motion Simulator experience
- a working observatory, complete with .5 meter reflecting telescope
- an auditorium and other additional rental/program rooms

The space centre enjoys broad appeal to a wide demographic range, drawing nearly 120,000 visitors annually. While this is a modest study, (examining why visitors come to the Space Centre as well as what they think, feel and know about space and astronomy topics) it will lay the foundation for an ongoing, extensive programme of research.

## 1.4 Audience Research and Front-End Studies

As Screven points out: “an understanding of consumer motivations is one essential factor in successful museum management” (Goulding, 1986). Audience or visitor study is fundamental to the overall planning and delivery of effective public service. It is useful in all areas of museum management including; strategic planning, revenue generation, audience development, marketing, fundraising, policy making, lobbying, visitor services, and exhibit, product and program planning.

### 1.4.1 Historical Overview

The field of audience studies does not have a long history, but it is an established area of specialization within the scope of cultural, heritage/cultural professions.

The following table summarizes some of the historical milestones of this emerging science; while the symbol highlights some Canadian points of interest (retrieved from Canadian Heritage Website http://www.pch.gc.ca/progs/arts/library/rubenste/client1_e.cfm#overview June 12, 2004).

Prior to 1900, published visitor studies are scant.

- **1920's and 1930's:** Psychologists A.W. Melton and E.S. Robinson (sponsored by the American Association of Museums) undertake major studies of visitor behaviour in exhibitions using observational methods in an effort to document the educational value of museums. Findings from their work resulted in the well-known concepts of exhibit *attracting power* and *holding power (*Hein, 1998).
- **1950's and 1960’s:** David Abbey and Duncan Cameron conduct visitor surveys at the Royal Ontario Museum (ROM). These ROM surveys are acknowledged in the field of visitor studies as the first systematic visitor surveys undertaken in museums and are still considered well worth reading today for their groundbreaking systematic approach to visitor surveys and museum participation.
- **1970’s and 1980’s:** experienced an explosion in visitor studies and evaluation focussing on evaluation research methods, behavioural studies and experimental studies *(*Hein, 1998).
- **1974:** The results of the first national study of why people do and do not visit museums, conducted in Canada by Brian Dixon, A.E. Courtney, and R.H. Bailey for the Secretary of State, are published.
- **1987:** The International Laboratory of Visitor Studies is established in Milwaukee by Chandler Screven to promote visitor studies through publications and seminars *(*Hein, 1998).

- **1988:** The Royal Ontario Museum's *Audience Research for French Language Interpretation in Exhibits* developed policy, procedures and guidelines for equitable bilingual services.
- **1988**: The Canadian Museum of Civilization's project *We Kids Need a Place to Find Out About Things* refined proposed target audiences and design concepts for what became the very successful Children's Museum, as demonstrated by ongoing attendance counts and evaluation studies (1991 and 1992).
- **1991:** The Visitor Studies Association is formally established as a professional non-profit association dedicated to visitor studies. This association is born at the Visitor Studies Conference held in Ottawa.
- **1994-1995:** The Manitoba Museum of Man and Nature's *Public Response and Marketing Strategy* projects delivered image, program and service direction for institutional planning and the building renewal program.
- **1990's and 2000's:** Visitor studies have grown rapidly with a wide range of professional researchers including George Hein, Chandler Screven and Lynn Dierking and John Falk who's publication, The Museum Experience, can be found in most museum professionals' resource library (Falk and Dierking, 1992).

### 1.4.2 Front-end Studies

The type, approach, method and focus of a visitor study is determined by the needs and purpose of the exercise. Visitor studies can be distinguished based upon the point at which they are administered. They are defined by Lynda Kelly (1998) as follows:

- **Front-end evaluation**: is conducted during the initial stages of a project to test concept ideas. Visitors' familiarity with, preconceptions of and interest in the subject matter are often examined as are their general understanding of exhibit themes. Front-end evaluation serves as a first step in incorporating visitor feedback into planning for new exhibits and programs. This type of study ensures: "that the voice of the audience is considered in the planning stages."
- **Formative evaluation:** tests program components during the design stages to isolate problems such as the placement of exhibit components or the content of a label. It is most often used during exhibit or program development.
- **Summative evaluation**: is conducted at project completion, after the installation of an exhibit or implementation of a program. The results help identify any remedial changes to the existing collection as well as inform future planning efforts.

*Examining Visitor Attitudes and Motivations at a Space Science Centre* is a therefore a front-end study; the first of it's kind to be executed at the H.R. MacMillan Space Centre.

## 1.5 Visitor Motivations and Agendas

Why do visitors come to museums/science centres? There are lots of leisure choices, many of which one has to pay for. So what motivations move a visitor to come to a museum or science centre and what does the management of the facility stand to gain from understanding them?

The number of museums and science centres has grown significantly in the past 50 years. While "museums are one of the most popular leisure venues in America" public attendance is on the decline leaving museum [as well as science centre professionals] compelled to look for ways to maintain or increase their visitor numbers (Falk, 1998). Understanding the visitors' agenda and motivations is key towards achieving that goal.

There is growing recognition that there is little research on visitor motivations and their impact on museum experiences. (Falk, Moussouri and Coulson, 1998, Goulding, 2000). Understanding why visitors come to museums is a complex issue involving a variety of social, psychological and economical factors. And while there are some researchers actively studying this, in the course of this study very few actual studies were found in the literature, which address visitor agendas and motivations within science centres specifically.

### 1.5.1 Classification Frameworks of Visitor Motivation

People give many reasons for visiting the various cultural centres, such as museums, galleries, zoos, planetaria and science centres. An individual's motivations, interests and prior museum experiences combine to create expectations for the visit; these are known as the visitor's agenda (Falk, 2000). By better understanding these motivations, science centre professionals will be better able to provide visitors with satisfying and fulfilling experiences.

Several researchers have broken down visitor motivations into a range of smaller components. Some of these findings are presented below.

Christina Goulding (2000) presents us with Moussouri's visitor agenda framework, consisting of 6 categories of motivation, which visitors expressed as a reason for visiting a museum. These are:

- Place: category of reasons given when museums are perceived as a leisure/recreational/cultural destination emblematic of a locale or region.

- Education: category of reasons related to the aesthetic, informational or cultural content of the museum.

- Life Cycle: category of reasons representing activity that takes place at certain phases in one's life. "I was taken to the museum as a child and now I'm taking my own children".

- Social Event: category of reasons referring to the museum visit as an "outing", a "day out for the family" or a social experience shared with a friend (s) or relative(s).

- Entertainment: category of leisure-related reasons. "Something to do in my spare time" or "to have fun" are typical responses.

In Christina Goulding's (2000) review of the literature on the subject, she also points to Screven and his classification of motivations as being either intrinsic or extrinsic.

- Intrinsic motivations are those reasons which focus on the usefulness of the visit, the coherence of context, timeliness, personal meaning, the opportunity to interact and the degree of challenge presented to the participant.

- Extrinsic motivations are those reasons, which include feedback and rewards such as tokens or privileges for achievement.

Finally, in developing a framework for describing visitors and non-visitors alike, John Falk (1998) makes use of the following categories for describing motivations:

- Demographic Variables: race, age, gender, level of education and salary

- Psychographic Variables: (characteristics, habits, attitudes, lifestyle and behaviour patterns that can help you identify your audience) Visitors are individuals who:
  - Value learning
  - Believe that they and their children should be continually learning or searching for new information
  - Perceive educational activities as having value
  - Perceive museum-going as a worthwhile leisure activity

- Personal and Cultural History: Adult behaviours are based/influenced by early childhood experiences and parental modeling. In this category, Falk points out "one of the best predictors of whether an adult will go to a museum is whether he was taken to museums by his parents when he was a child".

- Environmental Factors: cues and experiences within an individual's environment that influence museum going such as advertising, promotional campaigns and word-of-mouth recommendations.

Many of these ideas have influenced the structure and design of this study, and will be revisited later during the course of this work.

### 1.5.2 The Relevance of Visitors' Knowledge to the Constructivist Model

The Constructivist model, to which many museum professionals subscribe, asserts that visitors do not arrive equal, but bring with them an entire mental landscape of preconceptions, attitudes and feelings. These preconditions influence the nature of their unique, individual experience.

> "…it is assumed that each individual brings varied prior experiences and knowledge into a learning situation and that these shape how that individual perceives and processes what he or she experiences" (Falk, Moussouri, Coulson, 1998).

In order to fully understand constructivism, it is necessary to consider in depth the various theories and philosophies of education. This is beyond the scope of this study, but the principle elements of the constructivist model are as follows:

- Learners actively construct their own knowledge/meaning individually or within social groups
- The learner must be able to associate an educational situation with what is already known/familiar; the ideas and concepts a learner brings to a situation are major factors in mediating any learning that can take place
- Learners not only construct their own knowledge, they also construct their own, potentially unique, individual "truth".

According to George Hein:

> "Constructivism carries meaning making further, it views personal meaning making not only as necessary but also as desirable; not only something that needs to be tolerated, but a human attribute that can be exploited to enhance learning. From the constructivist perspective, meaning making is learning. The goal of an educational setting (such as that of a museum or science centre) is to promote learning and therefore facilitate meaning making." (Hein, 1999)

George Hein has conducted a great deal of research on the subject of constructivism. In particular, he has examined the relationship between museums and museum visitors. As a social constructivist, Hein favours the notion that museum visitors learn best when they have the opportunity to actively make their own meanings and "truths" in conducive environments, which are socially and intellectually accessible to all. His epistemological ideas represent both challenges and opportunities to modern museum professionals, encouraging the re-evaluation of how we design exhibits and programs to be more engaging for visitors.

For example, the model suggests that if personal meaning making is central to the learning process, then it is essential to find out what knowledge and experiences visitors bring with them to the museum. Without knowing this, it is impossible to ensure the their museum experience connects effectively and productively with their previous experiences. Essentially, looking at what knowledge visitors bring with them to a museum allows us to better direct what kind of experience they will ultimately have.

In his Theory of Multiple Intelligences, Howard Gardner (a developmental psychologist, familiar with constructivism) expanded the concept of intelligence to also include such areas as music, spatial relations, and interpersonal knowledge in addition to mathematical and linguistic ability. Gardner's multiple intelligence theory argues that there are at least seven ways to engage in thinking, each of which describes a unique cognitive style for understanding the world. The seven intelligences are: linguistic, musical, logical-mathematical, spatial, bodily-interpreting and organizing phenomena. Each intelligence is not to be analyzed independent of each other, rather, the intelligences are used concurrently and typically complement each other as individuals develop skills or solve problems. (Howard Gardner Website http://www.pz.harvard.edu/Research/Research.htm retrieved May 23, 2004)

This has important implications: if we subscribe to the view that human beings express a range of intelligences, then as museum professionals we need to explore multiple ways to engage the audience, exploiting all of these abilities when planning exhibitions or programs.

> "…The Constructivist Museum will provide opportunities for learning using maximum possible modalities for both visitor interaction with exhibitions and for processing information." (Hein, 1998)

Falk and Dierking have extended the constructivist model by developing a new framework, which they have termed *Free-choice learning* that explores how individuals exercise choices to participate in cultural and educational opportunities.

Examples of free-choice learning activities include: surfing the Internet, participating in book discussion groups, watching nature documentaries on television, borrowing books from the library, visiting museums and science centres with friends or family, etc. Free-choice learning activities are those which take place outside of schools and the workplace.

> "Although this form of learning is frequently referred to as informal learning, we at the Institute for Learning Innovation prefer to use the term free-choice learning to describe learning experiences which are non-sequential, self-paced, and voluntary. In other words, rather than defining learning by what it is not (non-formal), or where it occurs (informal), free-choice learning focuses on the characteristics of such learning--non-linear, personally motivated and most importantly, involving considerable choice on the part of the learner as to when, where, with whom, and what to learn."
> (Institute for Learning Innovation Website http://www.ilinet.org/contextualmodel.htm retrieved July 22, 2004)

In *Learning from Museums,* Falk and Dierking (2000) go on to suggest that there are three overlapping contexts – the *Personal Context*, the *Sociocultural Context*, and the *Physical Context* which contribute to and influence the interactions and experiences that people have when engaging in free-choice learning activities. They have identified eight key factors, which they believe collectively and individually affect the quality of a museum experience.

The 8 factors are:

***Personal Context Factors***

1. Motivation and expectations – People go to museums for many reasons. These motivations and expectations directly affect what people do and what they learn from the free-choice learning experience. When expectations are fulfilled, learning is facilitated. When expectations are unmet, learning can suffer.

2. Prior knowledge, interests and beliefs – Learners actively self-select what objects and experiences with which to interact. The meaning that is made of museum experiences are always framed within and constrained by prior knowledge, interests and beliefs. For these reasons, learning is always highly personal.

3. Choice and control – Learning is at its best when individuals can exercise choice over what, how, when and with whom they learn, and feel in control of their own learning.

***Sociocultural Context***

4. Within-group sociocultural mediation – Most museum visitors go to museums as part of a group. These groups have histories that separately and collectively form communities of learners. Peers build social bonds through shared experiences and knowledge. All social groups in settings like museums utilize each other as vehicles for deciphering information, for reinforcing shared beliefs, for making meaning.

5. Facilitated mediation by others – Socially mediated free-choice learning does not only occur within one's own social group. Powerful socially mediated learning can occurs with other people perceived to be knowledgeable such as museum explainers, presenters, guides and docents who can either enhance or inhibit visitor learning.

***Physical Context***

6. Advance organizers and orientation –People learn better when they feel secure in their surroundings and know what is expected of them. Tools to accomplish this might include facility guides and maps, descriptions of exhibits and pre-trip preparatory work. Psychologists refer to these as *Advance Organizers.* Museums tend to be large, visually and aurally novel settings. When people feel disoriented it directly affects their ability to focus on anything else. Providing conceptual advance organizers significantly improves people's ability to construct meaning from experiences.

7. Design – Much work has recently been done to build better, more immersive exhibit spaces in an effort to contextualise the ideas being presented. Effectively designed learning experiences are compelling tools for facilitating meaning-making.

8. Reinforcing events and experiences outside the museum - Free-choice learning does not respect institutional boundaries. People learn by accumulating understanding over time, from many sources in many different ways. The knowledge and experience gained from any one experience is incomplete; it requires enabling contexts to become whole. More often than not, these enabling contexts occur in other places; weeks, months and often years later. In other words, people come to museums with understanding, hopefully leave with more and then have the opportunity to develop this understanding further as they are presented with further experiences as they go about their lives.

The personal context as described above is most pertinent to this study.

Once again it can be seen that an understanding of the visitors prior experience and mental landscape can provide valuable insights that will assist in the planning and design of effective exhibits and program and so facilitate rich and successful learning experiences.

## 1.6 Case Study Review

There are relatively few studies in the literature addressing the issues considered here. Two rare examples are the studies conducted by Randi Korn and Associates (1992) and Mary Dusseault (1999). These are described below

1. Electric Space: The Sun-Earth Environment. Visitor Responses to a Front-End Evaluation. Prepared by Randi Korn and Associates 1992.

This study was conducted to "determine visitors' familiarity with, knowledge of and misconceptions about the make-up of space between the sun and the earth" (Korn, 1992). Specifically, evaluators examined what visitors knew about the four states of matter, familiarity with the Sun's structure and the concept of space as not being empty.

Evaluators used a variety of methods including questionnaires and flashcards. The flashcards included:

- images for visitors to identify
- words which visitors were asked to categorize and define, and
- illustrations which visitors were asked to label.

Lastly, visitors were asked for their reaction to the statement: "space is not empty". 50 visitors took part in the study.

Evaluators concluded that particular terms and concepts were difficult for visitors to grasp or adequately describe. Examples included terms and concepts such as "plasma", "solar wind", "magnetosphere" and the explanation behind "sunspots". This information provided valuable cues for exhibit designers, indicating where more work was required to improve their effectiveness. It was suggested that presenting a concept in a number of different ways increases the likelihood of successful understanding of a phenomenon.

Evaluators noted that visitors were reluctant to take part in the study, disliking the feeling of having their knowledge "tested" with what was perceived as intimidating subject matter. However, despite this negative initial reaction, respondents often went on to enjoy the interaction and wanted to review the correct answers to the questions after they'd finished. Often, as they worked through a question, respondents and their companions would become engrossed in conversation with everyone wanting to learn more. Evaluators therefore concluded that visitors enjoy learning in groups.

2. How do Visitors Understand the Universe? Studies Yield Information on Planning Exhibitions and Programs. Prepared by Mary Dusseault, 1999.

This intriguing study begins with the loaded statement:" A growing body of educational research has convincingly shown that many people (adults and children alike) hold inaccurate (but not essential) ideas about basic astronomical concepts" (Dusseault, 1999).

While these misconceptions can be difficult to grapple with, Dusseault believes that exhibit planners and designers can use them as "stepping stones to scientific understanding".

This paper outlines 4 studies conducted at the *Boston Museum of Science* and Chicago's *Adler Planetarium and Astronomy Museum*, aimed at exploring visitors' knowledge of astronomical topics.

Using props, questionnaires and cards games, the topics to be explored were:

- Day and Night/Reasons for the Seasons,
- Size and Scale,
- Picturing the Universe, and
- Ordering Space and Time.

In each case, the investigators determined that visitors possessed false preconceptions on a number of topics, including:

- the reasons for the seasons and their connection with the axial tilt of the Earth,
- difficulties regarding the size and scale of the objects of our Solar System, and
- the location of stars and other less familiar celestial objects.

Insights were gained into the types of experience visitors found particularly engaging, and this influenced later exhibit design work.

For example, in the Day/Night investigation, visitors enjoyed being able to move the portable light source, which represented the Sun, around an Earth globe. This led exhibit planners to incorporate movable, physical models into the exhibit they later created on the same topic. (Note: While the exact nature of the movable props used in this exhibit are arguably contributing to visitors misunderstanding of the Earth-Sun relationship [i.e. allowing visitors to move the Sun around the Earth can lead to the false assumption that the Sun therefore moves around the Earth], without speaking directly with the exhibit planners, a full summative evaluation or analysis of the exhibit's learning outcomes, this author does not feel it is constructive in this work to comment further.)

# 2. Methodology

## 2.1 Informal Interviews with Key Personnel

Interview objects:
John Dickenson, Managing Director, H.R. MacMillan Planetarium 1990-2004
Ian McLennan, Planetarium/Major Attractions Consultant

Informal interviews were conducted to provide background information on the planning and execution of the 1997 H.R. MacMillan Space Centre upgrade. Both individuals played a key role in the decision-making processes of the facility expansion project.

The informal interviews were of a relatively short duration (1/2 hour). They were free form, generally without a fixed list of questions, however in both cases they focussed on the process by which the H.R. MacMillan Planetarium was transformed into the H.R. MacMillan Space Centre.

## 2.2 Visitor Questionnaire (see Appendix B)

Due to time constraints, it was decided that a questionnaire would the best means of obtaining quantitative information, as these are relatively simple and straightforward to conduct with visitors in any one place throughout the Space Centre.

A questionnaire, consisting of 5 questions was developed with input from Space Centre staff. It consisted of a very "fun" look so as to be appealing for visitors to complete. The questionnaire was presented to visitors throughout the months of May and June 2004.

Visitors were approached and asked if they would be willing to participate in a research study concerning public knowledge of space and astronomy in order to facilitate improvements in future exhibits and programs. A token reward of some kind was typically offered, typically stickers, mission patches or whatever was to hand. Every attempt was made to make the experience a pleasant, social and engaging one.

For various reasons it was decided that it would be less productive to involve children in the survey, either separately or in family groups containing children. These included:

- Simplicity: the limited time and resources available for the project prohibited the development of the range of research methods that would be required to adequately deal with a wide range of ages.

- ? Practicality: engaging children involves a range of parental permission practicalities that complicate the process
- ? Relevance: as on of our goal s is to reach a better understanding of the visitors' decision to attend our facility, it was felt to be more valuable to focus on the adults who actually make this key decision rather than the children who accompany them

Therefore, any visitor (or group of visitors) approximately 18 years of age or older were approached.

Vancouver has a large population of English as Second Language residents and this was another factor determining whom would be approached. Again for practicality reasons, only visitors with a reasonable level of proficiency in English were approached, corresponding to an approximate reading age of around 12 years.

Questionnaires took approximately 15 minutes. Generally, visitors were happy to complete it, with 94 questionnaires being returned.

This study has both quantitative and qualitative elements. It is quantitative in the results are counted, scored and ranked. Some of the questions, however, are highly qualitative in nature, such as "how do you feel about space?" This fulfills two goals: the quantitative aspect provides some degree of measurability, whilst the qualitative elements allow for a richer scope for visitor responses without being limited by the preconceptions of the author.

## 2.3 What Does the Universe Look Like? Card Game (see Appendix C)

Using the same eligibility requirements as for the questionnaire (age, language), visitors were asked to participate in card game, developed by the researcher. Visitors were once again given a little background information regarding the use of the information gathered to improve the programmes and exhibits at the Space Centre.

Visitors who agreed to participate came to a table where a labelled picture of the Sun was placed on the left side. They were then given a series of cards depicting common space and astronomy images. They where then asked to place them in line extending to the right of the Sun, in order of distance. The cards consisted of the following images: Earth, Moon, International Space Centre, an astronaut, Mars, Jupiter, Pluto, a spiral galaxy and 2 stars (see Appendix D).

85% of visitors approached agreed to participate. The "game" took approximately 5 minutes to complete, with 45 sets of results recorded.

# 3. Results

## 3.1 Summary of Information from the Interviews

In the late 1980's, it was decided that a major renovation, restructuring and expansion would be required if the existing planetarium was to survive and continue to be a success as a major public attraction. Other possibilities, such as maintenance of the status quo, or even closure of the facility, were also considered and rejected.

Having reached this decision, it was necessary to build a convincing case to support the spending of the millions of dollars that would be required. A strategy was developed to build such a case, and included consultation with various parties, including:

- Politicians and public officials (at both provincial and municipal levels)
- Tourism authorities
- Schools and Educators
- Existing board members
- Facility staff and volunteers

Specific studies conducted for 1997 renovation included the following:

- Feasibility Study for Capital Campaign (1993)
- Proposal from IBI arguing the economic merits of the new Space Centre (1993)
- Survey Report by Ian McLennan on the state of planetaria that is still relatively appropriate (1995)
- Summary Report on Discussion with planetarium staff and board members of the existing planetarium programs and changes needed for the future (1995)
- Omnibus survey assessing awareness and attitudes to the planetarium (1996)

In addition, the following survey was conducted after the upgrade

- Omnibus survey measuring awareness of new Space Centre (1998)

Unfortunately, what is clear is that for whatever reason, the general public was not consulted: a front-end visitor study of any significant scope was not in fact done. The interviewees were unable to shed much light on this apparent deficiency. Cost was often cited as a limiting factor, and there was also high confidence that facility staff and management had a sound understanding of their target audience.

This study is therefore the first front-end study to be conducted at this facility.

## 3.2 Survey Questions

For each of the 5 questions, respondents were broken down into the following age categories:

- 18-29
- 30-55
- 55+
- Families with children <12
- Families with children >12
- Adult group 18-29
- Adult Group 30-55
- Adult Group 55+

A total of 94 surveys were completed with the following demographic breakdown as represented in Table #1:

**Table #1: Demographic Data**

| Age | # Surveys |
|---|---|
| 18-29 | 31 |
| 30-55 | 54 |
| 55+ | 12 |
| **Total Completed Surveys** | **94** |

**QUESTION #2: "Please rank the following leisure activities in order of importance."**

Visitors in each age category were asked to rank their preference for each of a given list of leisure activities on a scale of 1-5, where 1 represented least preference and 5 the highest preference for a particular activity. Table 2 below shows the number of respondents indicating each level of preference for each activity, broken down by age group.

**Table 2: Activity Ranking per Age**

| | | Preference Ranking | | | | |
|---|---|---|---|---|---|---|
| **Age** | **Activity** | **1** | **2** | **3** | **4** | **5** |
| 18-29 | Surfing the Internet | 6 | 6 | 4 | 5 | 6 |
| | Computer/Video Games | 12 | 4 | 3 | 0 | 2 |
| | Sports Game-Outing | 4 | 8 | 4 | 5 | 5 |
| | Science Centre-Outing | 4 | 6 | 11 | 2 | 0 |
| | Reading | 6 | 3 | 5 | 4 | 8 |
| | Gym | 5 | 2 | 8 | 9 | 2 |
| | Museum-Outing | 2 | 4 | 11 | 5 | 5 |
| | Park-Outing | 2 | 5 | 1 | 6 | 14 |
| | Movies | 1 | 4 | 11 | 6 | 6 |
| | Community Centre | 7 | 7 | 5 | 3 | 2 |
| | Shopping | 8 | 2 | 7 | 6 | 4 |
| | Concert | 3 | 3 | 5 | 6 | 7 |

| | | Preference Ranking | | | | |
|---|---|---|---|---|---|---|
| **Age** | **Activity** | **1** | **2** | **3** | **4** | **5** |
| 30-55 | Surfing the Internet | 14 | 9 | 10 | 5 | 7 |
| | Computer/Video Games | 23 | 10 | 3 | 1 | 4 |
| | Sports Game-Outing | 15 | 9 | 12 | 4 | 2 |
| | Science Centre-Outing | 4 | 10 | 14 | 8 | 6 |
| | Reading | 7 | 4 | 6 | 10 | 20 |
| | Gym | 5 | 5 | 7 | 11 | 14 |
| | Museum-Outing | 6 | 3 | 1 | 10 | 6 |
| | Park-Outing | 4 | 4 | 8 | 12 | 16 |
| | Movies | 4 | 8 | 10 | 10 | 11 |
| | Community Centre | 7 | 8 | 10 | 6 | 4 |
| | Shopping | 16 | 3 | 10 | 6 | 8 |
| | Concert | 9 | 9 | 9 | 6 | 7 |

| | | Preference Ranking | | | | |
|---|---|---|---|---|---|---|
| **Age** | **Activity** | **1** | **2** | **3** | **4** | **5** |
| 55+ | Surfing the Internet | 3 | 2 | 1 | 0 | 1 |
| | Computer/Video Games | 2 | 0 | 2 | 0 | 0 |
| | Sports Game-Outing | 2 | 1 | 0 | 0 | 2 |
| | Science Centre-Outing | 1 | 0 | 2 | 0 | 4 |
| | Reading | 0 | 0 | 0 | 3 | 5 |
| | Gym | 3 | 1 | 1 | 2 | 1 |
| | Museum-Outing | 1 | 1 | 0 | 4 | 3 |
| | Park-Outing | 0 | 0 | 0 | 2 | 4 |
| | Movies | 0 | 2 | 1 | 0 | 3 |
| | Community Centre | 1 | 0 | 2 | 1 | 1 |
| | Shopping | 2 | 3 | 3 | 0 | 1 |
| | Concert | 0 | 1 | 2 | 1 | 5 |

There are different numbers of respondents for each age group, which prevents us from directly comparing these scores. What was needed was an aggregate score for each activity across an entire age group.

To produce this, we performed the following mathematical manipulation:

S = Aggregate Preference Ranking for a particular activity across an age group

N = Total number of respondents in the age group

$n_x$ = The number of respondents in the age group awarding a preference value of x to the particular activity.

Therefore, for a particular activity;

$$\text{Aggregate Score } S = \frac{(1 \times n_1) + (2 \times n_2) + (3 \times n_3) + (4 \times n_4) + (5 \times n_5)}{N}$$

This will produce a 1 out of 5 score for the entire group. For example, if everybody in the group awards the activity a score of 5, then the aggregate score for the activity would also be 5. If half the individuals in the group award a score of 4, then the aggregate score for the activity would be 2.

These scores enable us to compare preference rankings across different age groups. This allowed us to plot the graphs presented in the Discussion section.

Table 2a presents the aggregate scores for the activity preference rankings broken down by age group.

**Table 2a: Activity Ranking Aggregate Scores**

| **Age:** | 18-29 | 30-54 | 55+ |
|---|---|---|---|
| | **Aggregate Scores** | | |
| Surfing the Net | 2.96 | 0.51 | 0.09 |
| Computer/Video Games | 1.85 | 1.85 | 2 |
| Sports Game-Outing | 2.96 | 2.26 | 2.8 |
| Science Centre-Outing | 2.47 | 3.04 | 3.85 |
| Reading | 3.19 | 3.68 | 4.6 |
| Gym | 3.03 | 3.57 | 2.63 |
| Museum-Outing | 3.25 | 3.17 | 3.78 |
| Park-Outing | 3.89 | 3.73 | 4.6 |
| Movies | 3.42 | 3.38 | 3.67 |
| Community Centre | 2.41 | 2.77 | 3.2 |
| Shopping | 2.85 | 2.7 | 2.44 |
| Concert | 3.49 | 2.49 | 4.11 |

**QUESTION #3: "Why did you come to the MacMillan Space Centre today?"**

Visitors in each age category were asked to rank the importance of each of a given list of motivations on a scale of 1-5, where 1 represented least important and 5 the most important motivation for their visit to the space centre. Table 3 below shows the number of respondents indicating each level of importance for each motivation, broken down by age group.

**Table 3: Motivation Ranking per Age**

| | | **Importance Ranking** | | | | |
|---|---|---|---|---|---|---|
| **Age** | **Motivations** | **1** | **2** | **3** | **4** | **5** |
| 18-29 | See Planetarium Show | 5 | 0 | 6 | 1 | 3 |
| | Something to do with friends | 6 | 1 | 2 | 4 | 7 |
| | Have fun | 1 | 1 | 2 | 4 | 9 |
| | Learn something | 2 | 3 | 3 | 6 | 3 |
| | School/work research | 7 | 2 | 2 | 2 | 3 |

| | | **Importance Ranking** | | | | |
|---|---|---|---|---|---|---|
| **Age** | **Motivations** | **1** | **2** | **3** | **4** | **5** |
| 30-55 | See Planetarium Show | 3 | 5 | 7 | 2 | 8 |
| | Something to do with friends | 1 | 6 | 5 | 5 | 11 |
| | Have fun | 0 | 0 | 3 | 10 | 15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Learn something | 1 | 2 | 2 | 7 | 16 |
| | School/work research | 7 | 3 | 1 | 1 | 6 |

| | | Importance Ranking | | | | |
|---|---|---|---|---|---|---|
| **Age** | **Motivations** | **1** | **2** | **3** | **4** | **5** |
| 55+ | See Planetarium Show | 0 | 1 | 0 | 1 | 2 |
| | Something to do with friends | 2 | 1 | 0 | 4 | 3 |
| | Have fun | 2 | 0 | 0 | 2 | 1 |
| | Learn something | 0 | 0 | 2 | 0 | 3 |
| | School/work research | 1 | 0 | 1 | 1 | 0 |

For each motivation, an aggregate score was obtained using the same process as described for the activity preference rankings.

S = Aggregate Importance Ranking for a particular motivation across an age group

N = Total number of respondents in the age group

$n_x$ = The number of respondents in the age group awarding an importance value of x to the particular motivation.

Therefore, for a particular motivation, the same scoring formula as above was used.

Table 3a presents the aggregate scores for the motivation importance rankings broken down by age group

**Table 3a: Motivation Ranking Aggregate Scores**

| **Age:** | 18-29 | 30-54 | 55+ |
|---|---|---|---|
| | **Aggregate Scores** | | |
| See a Planetarium Show | 2.8 | 3.28 | 4 |
| Something to do with friends | 3.25 | 3.68 | 3.5 |
| Have fun | 4.12 | 4.43 | 3 |
| Learn something | 3.3 | 4.25 | 4.2 |
| School/work research | 2.5 | 2.78 | 2.67 |

**QUESTION #4: "What words come to mind when someone says SPACE? (in order of importance) [factual associations]"**

Visitors in each age category were asked to provide a list of words that they associate with space. The length and contents of the resulting lists obviously varied between respondents, and Table 4 represents the "top 10 " most frequently occurring words together with the percentage of how many times each word was listed.

**Table 4: Factual Associations with the Word SPACE by Age**

| Age | Responses | % | Age | Responses | % |
|---|---|---|---|---|---|
| 18-29 | Stars | 64.5 | 30-55 | Stars | 37 |
| | Planets | 48.3 | | Planets | 35.1 |
| | Spacecraft | 38.7 | | Spacecraft | 35.1 |
| | Vast/Limitless | 25.8 | | Moon | 31.4 |
| | Exploration/Discovery/Adventure | 25.8 | | Vast | 20.3 |
| | Solar System | 25.8 | | Astronauts | 16.6 |
| | Meteors/Comets/Asteroids | 25.8 | | Aliens | 14.8 |
| | Aliens | 22.5 | | Mars | 12.9 |
| | Astronauts | 16.1 | | NASA | 12.9 |
| | Moon | 16.1 | | Galaxy | 11.1 |
| **Age** | **Responses** | **%** | | | |
| 55+ | Vast/Limitless | 66.6 | | | |
| | Spacecraft | 41.6 | | | |
| | Einstein/Carl Sagan/Physics | 33.3 | | | |
| | Dark/Black | 16.6 | | | |
| | Expense | 16.6 | | | |
| | Astronauts | 16.6 | | | |
| | Moon | 16.6 | | | |
| | Planets | 16.6 | | | |

**QUESTION #5: "How do you feel about space and astronomy? (emotional associations) List 2 or 3 thoughts."**

Visitors in each age category were asked to provide a list of emotions that they associate with space. The length and contents of the resulting lists obviously varied between respondents, and Table 5 represents the "top 10" most frequently occurring words together with the percentage of how many times each word was listed.

**Table 5: Emotional Associations with the Word SPACE by Age**

| Age 18-29 | Responses | % | Age 30-55 | Responses | % |
|---|---|---|---|---|---|
| | Interesting/ Fascinating | 29 | | Interesting/ Fascinating | 22.2 |
| | Mysterious/ Curious | 16.1 | | Mysterious/Curious | 18.5 |
| | Insignificance/Intimidating | 12.9 | | Fun/Exciting | 14.8 |
| | Awe/Wonder | 9.6 | | Religious/bigger picture/new age | 14.8 |
| | Important | 9.6 | | Scared | 11.1 |
| | Want to learn more | 9.6 | | Beyond Comprehension | 11.1 |
| | Fun | 6.4 | | Want to learn more | 9.2 |
| | Scared | 6.4 | | Technology/Advancement | 9.2 |
| | Beautiful | 3.2 | | Important | 7.4 |

| Age 55+ | Responses | % |
|---|---|---|
| | Important to Future/ Advancement | 50 |
| | Interesting/Fascinating | 33.3 |
| | Awe/Wonder | 25 |
| | Important | 25 |
| | Mysterious/Curious | 16.6 |
| | Beyond Comprehension | 16.6 |
| | Nostalgia (TV) | 8.3 |
| | Scary | 8.3 |
| | Beautiful | 8.3 |

## 3.3 What Does the Universe Look Like? Card Game

A total of 37 games were conducted with visitors. For each game, the number of errors, they type of errors and the age group of the respondent was recorded. The results are presented in Table 6.

**Table 6: Game Errors by Age**

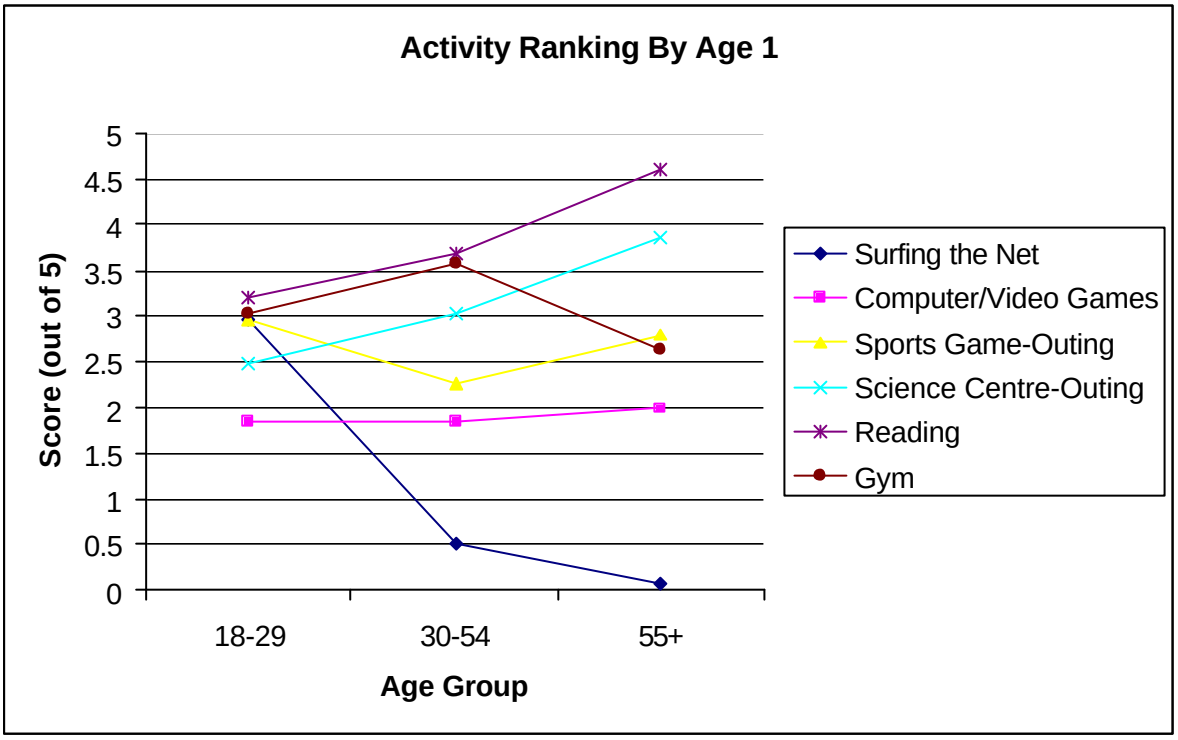
| Game # | # of Errors | Type of error | Age |
|---|---|---|---|
| 3 | 1 | astronaut in wrong place | child |
| 7 | 2 | Mars closer to sun than earth, stars placed outside our galaxy | 18-29 |
| 24 | 1 | stars placed near sun | 18-29 |
| 2 | 11 | just about everything wrong | 30-55 |
| 4 | 11 | just about everything wrong | 30-55 |
| 16 | 11 | just about everything wrong | 30-55 |
| 29 | 11 | just about everything wrong | 30-55 |
| 6 | 2 | Jupiter then Mars closest to Sun | 30-55 |
| 8 | 2 | Jupiter then Mars closest to Sun | 30-55 |
| 14 | 2 | Mars closer to Sun than earth, stars placed outside our galaxy | 30-55 |
| 36 | 1 | Mars and Moon inverted | 30-55 |
| 5 | 1 | Mars closer to Sun than Earth | 30-55 |
| 9 | 1 | Mars closer to Sun than Earth | 30-55 |
| 11 | 1 | Mars closer to Sun than Earth | 30-55 |
| 21 | 1 | Mars closer to Sun than Earth | 30-55 |
| 37 | 1 | stars placed inside solar system | 30-55 |
| 22 | 1 | stars placed near sun | 30-55 |
| 34 | 1 | stars placed near sun | 30-55 |
| 18 | 1 | stars placed outside our galaxy | 30-55 |
| 23 | 1 | stars placed outside our galaxy | 30-55 |
| 12 | 0 | correct | 30-55 |
| 13 | 0 | correct | 30-55 |
| 25 | 0 | correct | 30-55 |
| 26 | 0 | correct | 30-55 |
| 28 | 0 | correct | 30-55 |
| 31 | 0 | correct | 30-55 |
| 32 | 0 | correct | 30-55 |
| 33 | 0 | correct | 30-55 |
| 17 | 11 | just about everything wrong | 55+ |
| 20 | 1 | galaxy placed inside solar system | 55+ |
| 19 | 1 | mars closer to Sun than Earth | 55+ |
| 1 | 1 | stars placed outside our galaxy | 55+ |
| 15 | 1 | stars placed outside our galaxy | 55+ |
| 10 | 0 | correct | 55+ |
| 27 | 0 | correct | 55+ |
| 30 | 0 | correct | 55+ |
| 35 | 0 | correct | 55+ |

# 4. Discussion

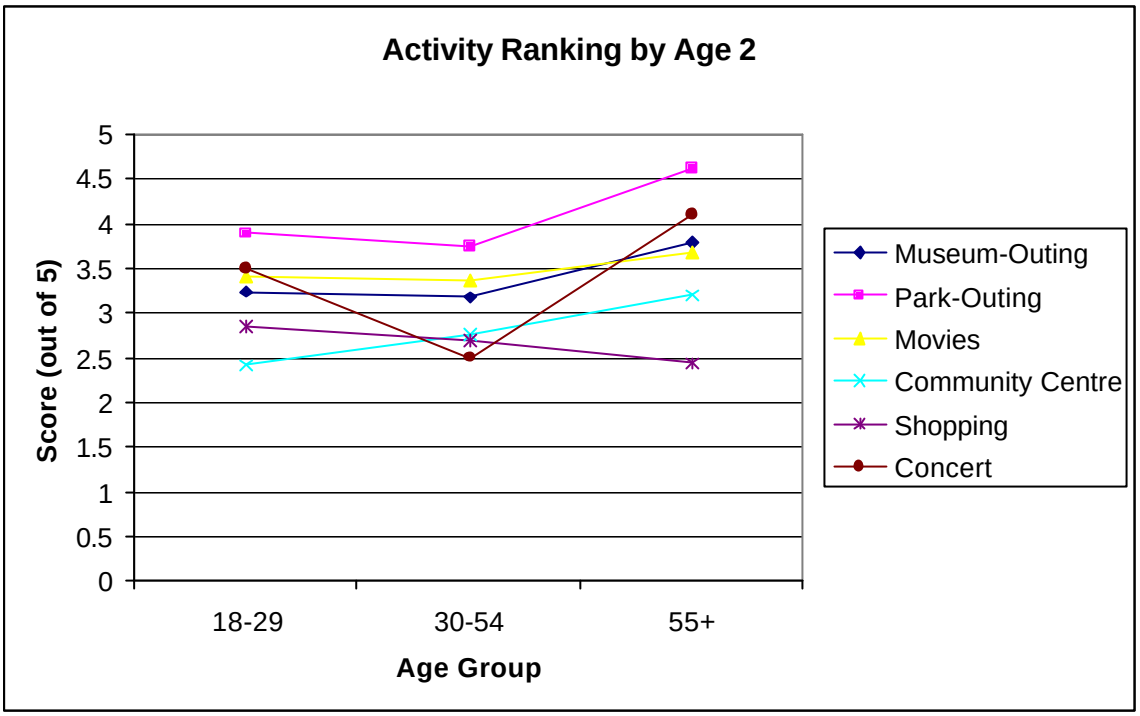
## 4.1. Rank the Activity

The results from table 2a were used to plot graphs 1 and 2 below. The results were split into 2 graphs for readability. The most striking features of these plots are discussed below.

**Graph #1: Activity Ranking by Age**



**Graph #2: Activity Ranking by Age (cont'd)**




**Analysis**

1. The popularity of *Surfing the Internet* displays the most striking dependence upon age. Popularity is moderate in the 18-29 group, but collapses dramatically in 30-54 and 55+ age groups. In fact, is by far the least popular activity amongst these groups. This is the strongest age dependence we see anywhere in our data, revealing a stark "Internet Divide" between the youngest group and the older respondents.

In 2002, an estimated 7.5 million households (64.2%) had at least one member who used the Internet regularly, either from home, work, school, a public library or another location. Of these, where the head of the home was aged 65 years or older, only 24.9% used the Internet regularly. Reasons for this may include:

- *Retirement/Access*: As most older people do not have access to workplace training, they have to make the effort to find other ways to learn these new technologies

- *Cost*: Most often, they rely on their own resources to purchase a computer and get an Internet connection. Since many retired people live on low incomes, family and community resources are important ramps onto the information highway for the older generation. (Statistics Canada Website http://www.statcan.ca retrieved August 3, 2004).

This could have important implications for the facility. For example, is the web an effective medium for program promotion if older age groups are an important component of the target audience? This data strongly suggests that this is a poor medium to use to reach this potentially important demographic group.

Seniors constitute one of the fastest growing groups in Canadian society today. By 2041, it is estimated that nearly 23% of the population will be over 65, up from 12% in 1995 (Statistics Canada Website http://www.statcan.ca retrieved August 3, 2004).

2. *Computer/video games* scored received the lowest rankings of all the activities. Only Internet use in the 30-54 and 55+ age groups recorded lower scores. This was therefore the most unpopular activity overall. Also, unlike web surfing, there is no age dependency; computer gaming is relatively unpopular across the board!

This is an important result, given that computer games are often used as the basis for many contemporary exhibit designs. This strategy could be a mistake, and this data suggests that computer games are not a medium that our visitors find engaging.

3. *Reading* was particularly popular, scoring highly across all age group and tying with *park outing* for the most popular activity in the 30-54 and 55+ age groups. This may be taken to broadly reflect the level of education of our visitors. It should probably not be taken to support the assertion that text-based exhibits would be effective. This would seem to be supported by a number of studies that indicate that these kinds of exhibits are of limited value (Rennie and McClafferty,1999, Semper, 1990).

4. *Visiting a science centre* was moderately popular across all age groups, increasing with age. The age profile closely resembles that of the scores for reading.

It is interesting to note that the preference scores closely match those for *museum outings* for both the older age groups. However, *museum outings* were distinctly more popular in the youngest group. Why is this?

Perhaps it is worth recalling the very strong age polarization we saw in *surfing the web.* We could be seeing here the results of different attitudes and expectations regarding technology in the youngest age group. Are the 18-29 year olds harder to impress with science based exhibitry and content? Alternatively, perhaps museum exhibits are inherently a more novel and rewarding experience for the younger age group when compared to the science centre experience.

5. *Park Outings* are highly popular across all age groups, tying for first place with *reading* and with a clear lead in the 18-29 group. This strongly suggests they may be value to incorporating park-like elements into the science centre experience.

The H.R. MacMillan Space Centre is fortunate to reside in an excellent waterfront park setting. Outdoor exhibitry is an interesting possibility. Outdoor play, picnic and catering areas could also be attractive additions that would enhance the visitor experience.

**Trends and Patterns**

1. In many of the plots we see a distinct upward curve to the right. Indeed, this is a feature we see in 9 out of 11 of the activity rankings. This shows an increase in preference for almost all these leisure activities in the 55+ age group. This could reflect the greater leisure opportunities enjoyed by this age group, which includes retirees and older individuals with greater freedom from immediate family commitments.

Given the demographic trend towards a growing older population, it could be important to note that this age group also expresses elevated interest in leisure activities in general, including museum and science center visits.

Statistics Canada reports that seniors generally have more leisure time than people in younger age groups. They spend considerable parts of their day socializing, engaging in regular physical activity or participating in other passive recreational activities such as reading. As well, seniors are travelling more than they did in the past. (Statistics Canada Website http://www.statcan.ca retrieved August 6, 2004).

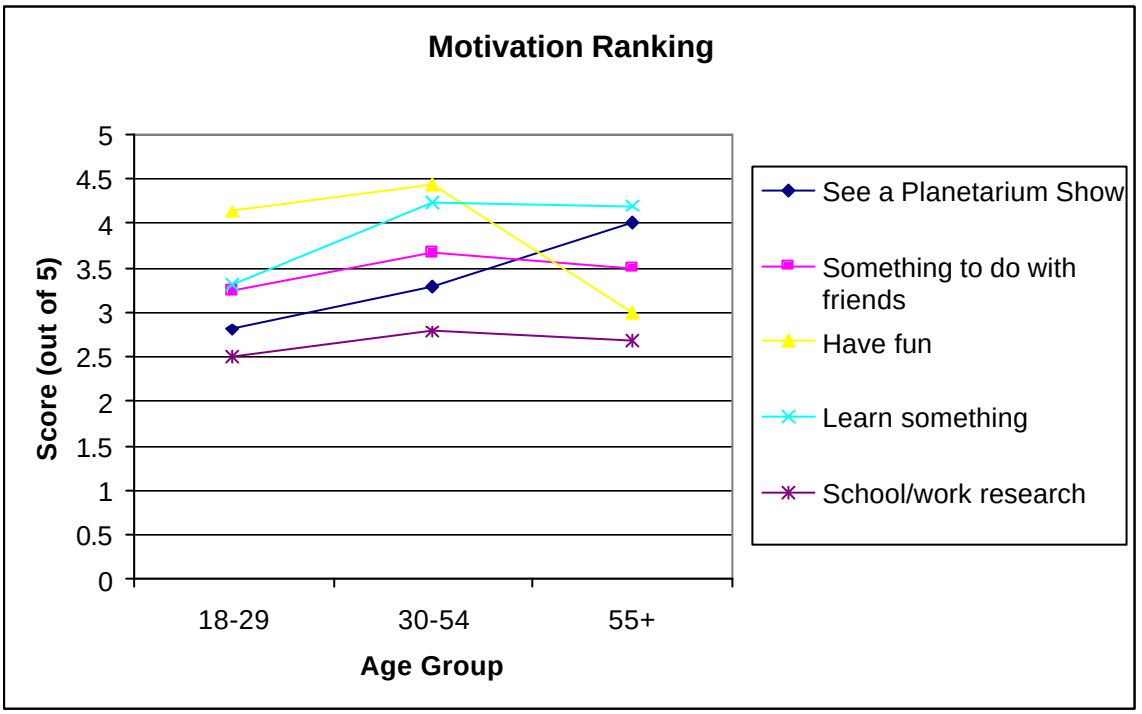
2. In several of the preference plots, we see a decline in interest in the *30-54* age group, which includes the bulk of the parenting age group. This is clear in 3 out of 11 cases: *sports outings, concerts, park outings* with a slight decline also visible in the *movies* and *museum outings* categories. All these leisure activities involve outings away from the home. Perhaps importantly, they all are with the exception of *park outings* associated with ticket costs. We may be seeing here the impact of the larger family group raising the costs and logistic challenges of leisure outings. This may suggest that the natural demand for these activities is being measurably suppressed by these factors. This should be born in mind when reviewing ticket-pricing policies. It may also influence decisions regarding other facility services and amenities that are 'family-friendly'.

…Perhaps not surprisingly, the only activity to buck this trend of decreasing interest in the middle years is *gym attendance*, perhaps for obvious reasons…

## 4.2 Motivation Ranking

The results from table 3a were used to plot graphs 1 and 2 below. The most striking features of these plots are discussed below.

**Graph #3: Motivation Ranking by Age**




**Analysis**

1. The motivation *To see a planetarium show* received only modest ratings, and in fact is the second least-popular motivation in the 18-29 and 30-54 age groups. There is, however, a distinct increase in this motivation with age, and indeed it becomes the second *most* popular in the oldest age group. Why is this?

The Planetarium has a prominent history and identity among Vancouver residents. It is possible that "going to see a planetarium show" is a popular motivation for older groups because the facility enjoys much stronger recognition with this demographic. Also the H.R. MacMillan Space Centre is very strongly associated with the H.R. MacMillan *Planetarium* that preceded it on the same site.

If we recall point 4, *visiting a science centre* (above), we noted that the youngest diverged from the other age groups in being less interested in visiting science centres. It was suggested that this age group are more difficult to impress with the scientific and technological exhibitry and content. This may also explain their relative lack of enthusiasm for the planetarium.

2. *Something to do with friends* scored strongly in popularity with all ages. This reinforces several studies, which have shown the importance of the social aspect as a motivating factor for visiting science centres and museums. For example, Moussouri (Goulding, 2000) listed "social event" as a motivating factor for such visits.

3. *To have fun* was the most popular motivation with the striking exception of the 55+ age group. Referring to Falk and Dierking's Free-Choice Learning model, people exercise choice in deciding were to enjoy their free-choice learning experiences, and having fun is obviously a large motivating factor in the making of those choices. In short, make the place fun so people will want to come.

4. *To learn something* was a high motivation for all groups, tying for first in the 30-54 age group and taking first place for the 55+ group. Perhaps this is driven by the same values as the *reading* preference curve. The data indicates that education and learning are considered by all groups to be worthwhile and rewarding.

This ties in well with current academic theories on museum-going motivation. In his study, Moussouri (Goulding, 2000) listed education (as related to the aesthetic, informational or cultural content of the museum) as one of his 6 motivational factors. Falk (1998) also identified a number of characteristics, or 'psychographic variables' that were typically found in museum visitors. Generally, they:

- Value learning
- Perceive educational activities as having value
- Perceive museum-going as a worthwhile leisure activity

The lack of an increase in the motivation curve for the oldest age may simple result from the fact that we have already reached the top of the scale for the middle age group. There is nowhere for the upward trend to go!

5. *School Work and Research* were consistently the lowest motivating factor across all ages. It is important to not that our respondents are the visiting public and do not include school groups. For such groups, this factor could obviously be of much greater importance. However, it would seem that in a 'Free-Choice Learning' context, which is more applicable to the public visitor, connections with formal schoolwork are not of great importance.

**Trends and Patterns**

All motivations showed a distinct drop in the 18-29 age group. It is difficult to see any conclusion that is supported by this observation.

## 4.3 Factual Word Associations

Table 4 presented a 'Top 10' list of words most frequently associated with the word *space.*

1. *Stars, Planets* and *Spacecraft* are far and away the favourite associations in young and middle age groups.

2. The *Moon* scores substantially higher with the middle age group than with the youngest. This group also has the strongest association with the word *Astronauts*. This may reflect the strong influence of the late '60s and early '70s moon landings upon this age group.

3. Interestingly, the younger group was the only group to mention *Exploration/Discovery/Adventure*. In fact, it was also given a fairy high ranking. This would seem to be an aspect of space travel that has a particularly strong appeal to the younger audience.

4. The overlap between the younger and middle age groups is respectable, with 6/10 words common to both lists and strong similarities in ranking. For example, they share the same top three items, *Stars, Planets* and *Spacecraft.*

5. The oldest group diverges most strongly from the other two, with a 5/10 overlap with the younger group and a 4/10 for the middle group. Also, even when words are shared between the groups, the older group shows a very different ranking. For example, *planets* is point 10 for this group compared to point 2 for the younger groups. This implies that the underlying divergence is greater than the word overlap counts themselves suggest.

6. There are several interesting associations only present in the older group. They are the only group to mention *Expense*. Perhaps these individuals are more likely to recall the controversy surrounding the costs associated with the spectacular space programs of the 60's and 70's. Also, they are the only group *not* to mention *Aliens*.

Interestingly, they are also the only group to make an explicit scientific connection, referring to Physics and specifically mentioning Einstein and Carl Sagan. Perhaps this reflects the greater intellectual maturity of this group.

Overall, there is a very strong indication that the older group has a distinct set of attitudes and associations when compared to the other two age groups. Their mental landscape appears to be significantly different.

## 4.4 Emotional Word Associations

Table 5 presented a 'Top 10' list of emotions most frequently associated with the word *space*.

1. *Interesting/Fascinating* is at or near the top for all three groups. This would seem to provide a robust affirmation of the public interest in space and space science.

2. *Mysterious/Curious* also scores highly, with the number 2 position in the younger groups and a respectable 5$^{th}$ position with the older group.

3. *Important/Future Advancement* is given modest ranking by the 18-29s and 30-54s, but receives an emphatic top score with the 55+ group. This would seem to support the assertion that the older group is more concerned with the future, although all groups recognize the issue to some degree.

*4. Want To Learn More* achieves modest prominence in the younger two groups. It's absence from the older age group is puzzling, particularly as *To Learn Something* scored highly as a motivation for them in graph.3. This may be a result of modest sample size and a low response rate from this age group.

*5. Fun* is present in both the 18-29 and 30-54 groups, but not the 55+ group. This is once again evidence for a significant shift in mindset in the 55+ group.

5. Most associations appear positive, often strongly so (e.g. *wonder, beautiful, fun, exciting*). The exceptions are *Scared, Insignificance/Intimidating* and *Beyond Comprehension.* These negative associations appear to share the same roots around the ideas of fear of the unknown, insecurity and insignificance.

## 4.5 What Does the Universe Look Like? Card Game

The results from Table 6 were used to create Graph 4 and Table 7. The most striking features of these are discussed below.

**Graph #4: Error Distribution**

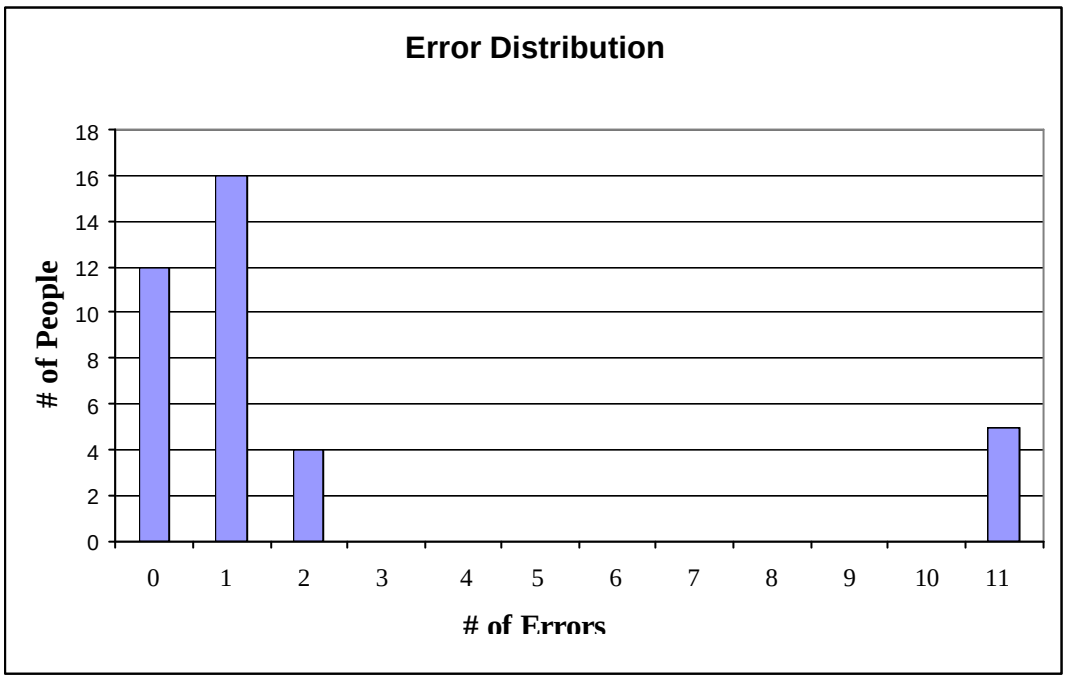



**Table 7: Types of Errors**

| | # Errors in Age Group | |
|---|---|---|
| **Type of Error** | *30-54* | *55+* |
| correct | 32% (8) | 44% (4) |
| everything wrong | 16% (4) | 11% (1) |
| incorrect order of planets | 32% (8) | 11% (1) |
| stars inside solar system | 12% (3) | 0 |
| stars outside of galaxy | 12% (3) | 22% (2) |
| galaxy placed within solar system | 0 | 11% (1) |

**Analysis**

From the data in Tables 6 and 7, the following observations can be made:

1. 32.5% of visitors were able to correctly line up the cards in order of distance from the Sun.
2. 67.5% of visitors made at least one mistake, and these break down as follows:

- 43.2% of visitors made one mistake
- 10.8% of visitors made two mistakes
- 13.5% of visitors made many mistakes

3. Interestingly, there is a polarisation in the pattern of errors in that 86.5% of respondents made only 0 to 2 mistakes. There is a large gap in the midrange, with nobody making 3 to 10 errors. Finally, there is a minority of 13.5% who are making numerous errors, with almost everything wrong. This is illustrated in Graph 4.

Essentially, we have a large majority who have a relatively sound conception of the cosmos, and a significant minority who seem to lack even the most basic knowledge. This suggests that a science centre's content, programming and exhibitry should be developed so that it caters for visitors with widely different levels of knowledge, skills and learning styles. This will allow all visitors to successfully build understanding. This is very much consistent with Hein's constructivist model, where he concludes that each visitor brings a unique perspective and will receive a unique meaning-making experience from their visit.

Taking this further, it seems likely that, given a wide range of abilities, each individual is likely to respond most effectively to different types of learning experience. This would result from each individual employing different modes of intelligence according to their strengths and preferences as proposed by Gardner in his theory of multiple intelligences.

4. From Table 7, the types of error made fall into a number of distinct classes:

- Incorrect order of planets
- Stars inside solar system
- Stars outside galaxy
- Galaxy placed inside solar system
- Everything wrong

The last 4 classes of errors all involve misconceptions regarding the relationship in scale between the solar system, other stars and galaxies. This is in accordance with the results obtained by Mary Dussault and her colleagues (1999) which indicated that visitors had misconceptions with regards to which objects are found within our Solar System and which are without.

5. From Table 7, the 55+ group to possesses better factual knowledge:

- 44% are correct compared to 32% for the 30-54 age group.
- only 11% made an error regarding ordering of the planets, compared to 32% for the 30-54 age group .

(Note: Due to small sample size (only 3 games) it is not possible to draw any useful conclusions regarding the 18-29 and child respondents.)

# 5 General Conclusions

If the role of a science centre is to educate and entertain the public, a constructivist approach reminds us that visitors do not arrive as blank slates, but rather they arrive with a varied set of knowledge, attitudes, beliefs and motivations. A better understanding of the range and nature of these preconditions will enable a facility such as the H.R. MacMillan Space Centre to provide a more fulfilling and successful experience for visitors. Conducting the front-end study, *Examining Visitor Motivations and Attitudes at a Space Science Centre*, is one step towards achieving that goal.

## 5.1 Results vs. Theory

In examining our data, we are now able to compare our results with established theories on the topic of visitor motivations and agendas.

In reviewing the results, we observe that *Something to do with friends, To have fun* and *to learn something* scored highly, indicating that education and learning are considered by all groups to be worthwhile and rewarding.

This reinforces several studies, which have shown the importance of the social and learning aspects as motivating factors for visiting science centres and museums. In particular, Moussouri and Falk, who in a number of studies discovered that a majority of visitors do indeed cite these two reasons (education and entertainment) for visiting museums. Visitors therefore come both to learn and to have fun (Falk, 2000). *Examining Visitor Motivations and Attitudes at a Space Science Centre* achieved very similar results.

The following table compares the motivational frameworks compiled by Falk, Moussori and Martin.

| **MOUSSOURI** | **FALK** (psychographic profile of visitors) | **MARTIN** (Psychographics and motivations as determined by this study) |
|---|---|---|
| *Place*: category of reasons given when museums are perceived as a leisure/recreational/ cultural destination emblematic of a locale or region. | Visitors Value learning | |

| | | |
|---|---|---|
| *Education*: category of reasons related to the aesthetic, informational or cultural content of the museum. | Visitors perceive educational activities as having value. | Visitors visit museums and science centres for their educational value. |
| *Life Cycle*: category of reasons representing activity that takes place at certain phases in one's life "I was taken to the museum as a child and now I'm taking my own children". | Visitors perceive museum-going as a worthwhile leisure activity | Visitors perceive museum and science centre going as a worthwhile leisure activity. |
| *Social Event*: category of reasons referring to the museum visit as an "outing", a "day out for the family" or a social experience shared with a friend(s) or relative(s). | Visitors believe that learning is a life-long process not limited to what takes place in schools. (they enjoy free-choice learning activities). | In general, we see an increase in preference for many free-choice learning activities as we age. The exception is with family-aged adults.<br><br>Family-aged adults prefer simple activities probably due to costs and logistics i.e.<br><br>Visitors visit museums and science centres for a social experience. park outings. |
| *Entertainment*: category of leisure-related reasons. "Something to do in my spare time" or "to have fun" are typical responses. | Visitors want to be entertained. | Visitors visit museums/science centres to be entertained. |

"To understand museum learning requires an understanding of why someone would choose to go to the museum and what effects those factors have on learning once the person gets there" (Falk, 2000)

As Hein (1999) suggests, understanding that visitors do not arrive as blank slates, museum and science centre professionals can better communicate their facility's messages. Applying Gardner's theories of multiple intelligences to well thought-out exhibit design and programming can help ensure that visitors leave with a wider perspective on the topic than what they came in with.

## 5.2 Age-Dependant Variations

It is obvious from the data that the different age groups possess distinct sets of values, attitudes and preconceptions on the topic of space and astronomy.

The 18-29 age group is unique in possessing a strong preference for surfing the Internet. They were the only group to associate space with the terms *exploration, discovery, adventure* and *fun*. Interestingly, they agreed with other age groups in valuing visiting museums, but showed a suppressed interest specifically in visiting science centres. They also recorded the lowest level of motivation to see a planetarium show. Why is this? Perhaps they are technologically and scientifically savvy and therefore a difficult group to impress with this kind of content and exhibitry.

The 30-54 age group generally has a good deal in common with the younger group in free-choice learning preferences, visit motivation and associations. However, the data does display a noticeable suppression of free-choice learning activity preferences involving outings. This may be the result of additional logistical challenges and ticket costs for larger family groups.

*In many ways, the 55+ group displays the most interesting and perhaps surprising contrasts to the other two groups.*

Firstly, the data shows an increase in preference for almost all free-choice learning activities in this age group. The exceptions are surfing the Internet and playing computer games. Indeed, the data shows a clear *Internet Divide:* surfing the Internet provides the biggest age-dependant variation we see in any of the activity preference data, being highly popular with the young and equally highly *unpopular* with the 55+ group. Despite this, the increased activity preferences for all other activities could be a reflection of the greater leisure opportunities enjoyed by this group.

This group also diverges substantially in terms of factual and emotional associations with space. Not only do the list of word-associations differ in content, but even when the same words are present across the age groups, the 55+ list of ten give the same words very different emphasis. For example, *important to future advancement* is given a low emphasis by the younger groups, but is top of the list for the 55+ group. They are the only group to mention the association *expense*, and conversely they are the only group to omit the association *fun.*

Overall, there is a very strong indication that the 55+ group has a distinct set of attitudes and associations when compared to the other two age groups. Careful consideration should therefore be given to meeting this groups needs and expectations.

## 5.3 Overall Conclusions

*Computer/video games* received the lowest preference rankings of all the listed free-choice learning activities. Indeed, this was the most unpopular activity overall across all the age groups.

*Park Outings* are a highly popular leisure activity across all age groups. This suggests that, where practicable, incorporating park-like elements into the visitor experience may well be an interesting way to capitalize on visitor enthusiasm for this kind of activity. Development of outdoor spaces, exhibits and programmes may well enhance the visitor experience and be beneficial to facility. The H.R. MacMillan Space Centre, already located in a park, may benefit from exploring this idea further.

The motivations *To learn something* and *Something to do with friends* scored strongly in popularity with all ages. This is in agreement with results obtained by Falk, Mousouri and Coulson (1998) who concluded that virtually all visitors cited education and entertainment as a reason for visiting the museum, that visitors are seeking a learning-oriented entertainment experience.

The motivation *To see a planetarium show* was poorly supported by most ages, with the exception of the 55+ group.

Regarding pre-existing factual knowledge, we find there is a large majority who have a relatively sound conception of the cosmos, and a significant minority who seem to lack even the most basic knowledge. Also, it is noted that while *Stars*, *Planets* are far and away the favourite associations, they are also those areas yielding the majority of factual errors in cosmological knowledge. The scale relationship between the solar system, other stars and galaxies seems to be particularly misunderstood.

Finally, the data does seem to show a healthy enthusiasm for space-related topics. Strong word associations include *Interesting/Fascinating* and *Mysterious/Curious* and there are many other positive associations such as *wonder, beautiful, fun* and *exciting.* Negative associations include *Scared, Insignificance/Intimidating* and *Beyond Comprehension,* and even these nonetheless indicate a strong emotional connection with the content.

This study suggests there is a bright future for facilities that, through intelligent and innovative programming and exhibit design, are able to satisfy and fulfill the high natural levels of interest displayed by the public for space science and astronomy.

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# Appendix A: The H.R. MacMillan Space Centre

**Photo Gallery**

The H.R. MacMillan Space Centre

The Gordon MacMillan Southam Observatory

The Planetarium “Star Theatre”

GroundStation Canada

The Cosmic Courtyard Exhibit Gallery

# Appendix B: MacMillan Space Centre Visitor Survey

**Is the Space Centre meeting your expectations? Help us make your Space Centre experience even better by completing this short questionnaire!**

**PART 1: Demographic Data**

| Individual M/F<br><br>18-29 30-55 55+ | Group Family w Children <12<br>Family w Children >12<br>Adults 18-29 30-55 55+ |
|---|---|

**PART 2: Visitor Attitudes/Motivations Towards Space Centre and Space Science**

A) Please rank the following leisure activities in order of importance.

5 = most important
1= least important

Surfing the Internet
Computer/Video Games
Going to a sports game
Going to a science centre
Reading
Going to a museum
Going to the park
Going to the movies
Going to a community centre
Shopping

B) Why did you come to the MacMillan Space Centre today? (rank the following)

5 = most important
1= least important

To see a Planetarium show
Something to do with friends
Have fun
To learn something
School work/research
Other? _____

C) What words come to mind when someone says SPACE? (in order of importance) [factual associations]

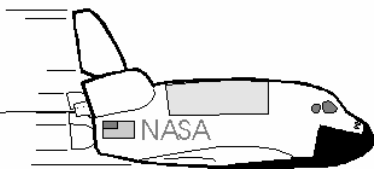
1. 2.

3. 4.

5.

D) How do you feel about space and astronomy? (emotional associations) List 2 or 3 thoughts.

Thank-you! Please return completed survey to Guest Services Staff.



# Appendix C: What Does the Universe Look Like Data Sheet

**PART 1: Demographic Data**

| Individual | M/F |
|---|---|
| 18-29 30-55 55+ | |

| Group | Family w Children <12 |
|---|---|
| | Family w Children >12 |
| | Adults 18-29 30-55 55+ |

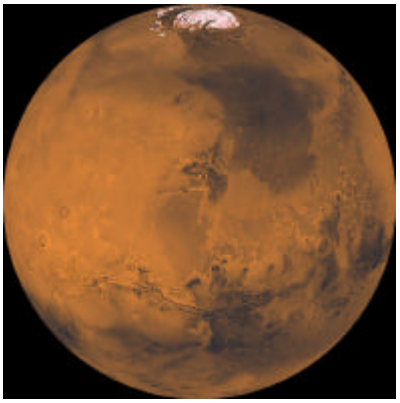
**NOTES:**

This game was played on a large, table surface. The “player/respondent” was given the task of placing a number of astronomical images in a line extending to the right of the Sun, in order of distance.

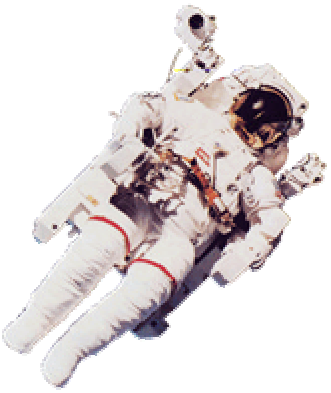
# Appendix D: What Does the Universe Look Like –Card Images

**The Sun**

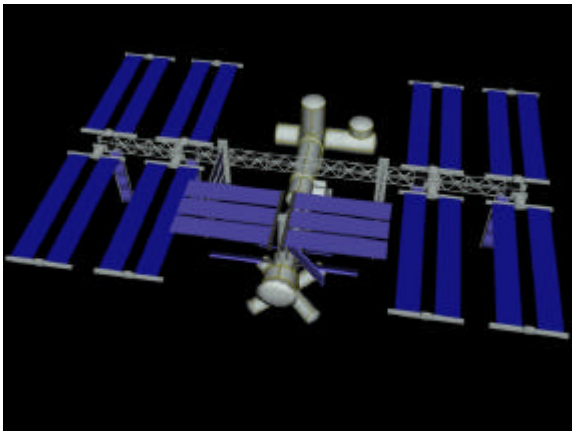
**The Earth**



**Mars**



**Astronaut**



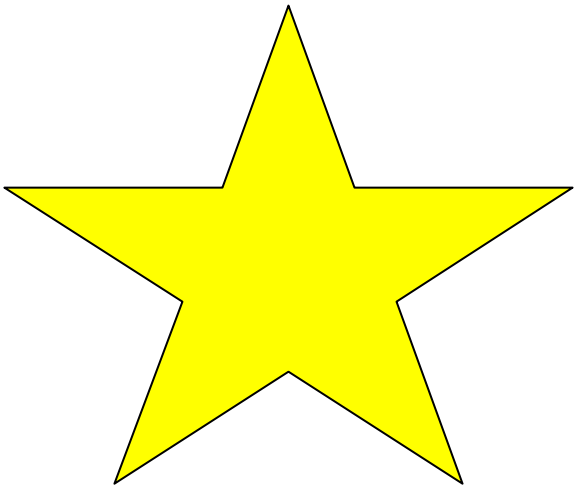
**International Space Station**

**Our Moon**

**Jupiter**

**Artist's Rendition of Pluto**

**Other Galaxies**



**Stars**