

# StarFlight

May 31, 2006

## ***Development Team***

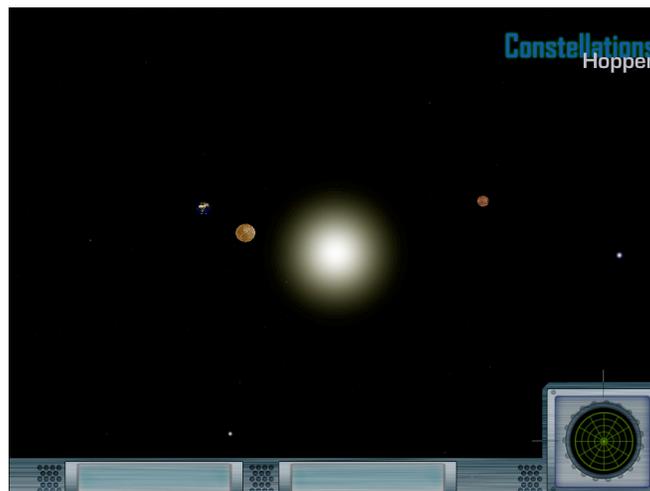
Jim Sweitzer, Program Coordinator  
Brenda López Silva, Project Leader  
Timothy Donaghy, Creator  
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## ***Goal***

To create a fun, video-game-like environment for exploring the local universe of stars through a mix of guided instruction and free-form interaction so as to educate about the relative distances of the stars we see and the planets in our Solar System, the three dimensional distribution of the stars in the sky, and to build intuition about how apparent brightness of the stars changes with distance

## ***Description of Project***

*StarFlight* is an interactive computer-based audio/visual program that mingles an astronomical message, with a lesson in mythology, and the excitement of video game-like space travel. Using the Hipparcos catalogue, a data set mapping 120,000 actual star positions taken by the Hipparcos Satellite, this program aims to elucidate the vastness of space by demonstrating the three dimensional nature of the constellations. The program is formatted for both guided constellation tours and manually-controlled free flight, allowing the user to interact at multiple levels dependent on their own interest. *StarFlight* has been widely and enthusiastically enjoyed for its combination of user control, appealing visuals, and intriguing yet factual balance of science and mythology within the narration



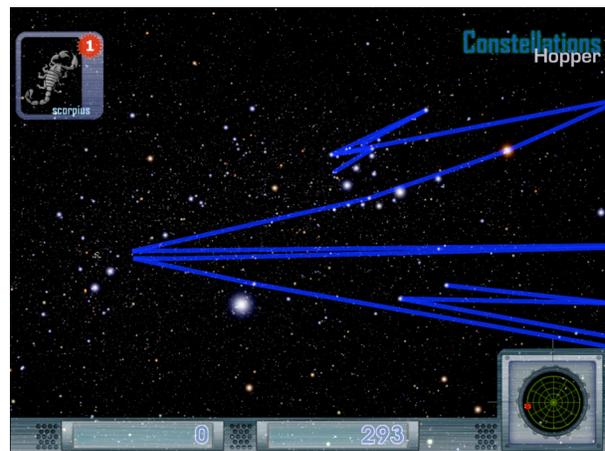
[Figure 1]

The introduction to the program commences on earth, looking at the night sky, highlighting and defining various constellations as we see them from here. Next follows a blast off sequence, beginning at the Adler Planetarium in Chicago continuing through the solar system (Figure 1) and ending in full view of our galaxy of stars.

The user may choose from either one of three guided constellation tours or manually-controlled free flight. Each constellation tour starts from our sun and follows a predetermined flight path towards and around the given constellation, with a narration that details both astronomical principles and the mythology behind the shapes. These tours directly exhibit the constellation as a subjective shape, whose ascription from view on earth does not align with the actual position of the stars in space. For example, Figure 2 shows the constellation Scorpius as it is seen from earth and Figure 3 shows this same constellation as it is viewed from the side, 293 light-years away from Earth.

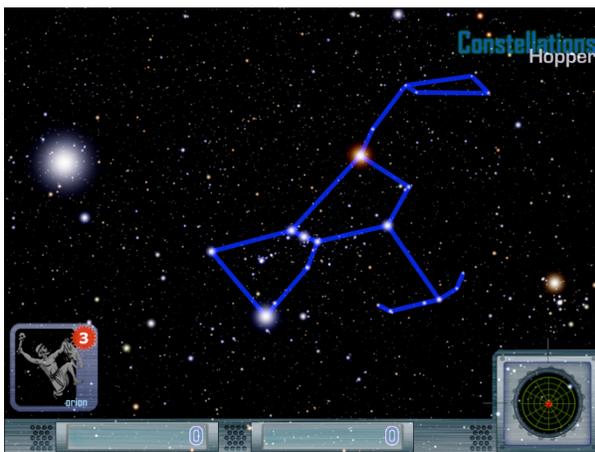


[Figure 2]

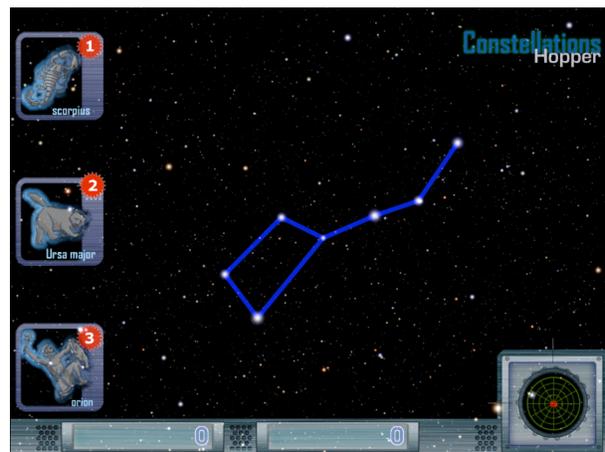


[Figure 3]

As can be seen, the scorpion shape is now disfigured and one can identify stars in relative distance to the earth. The other two constellation tours available in the program are Orion (Figure 4) and Ursa Major, including the Big Dipper (Figure 5).



[Figure 4]



[Figure 5]

## ***Development***

The exhibit was developed using the ‘Electro’ application development environment written by Robert Kooima. Electro can be easily run on Linux, Windows or Mac platforms, and can be displayed on a variety of display environments including desktop systems, tiled displays and GeoWall. An application called ‘Total Perspective Vortex’ had already been developed in Electro that allowed the user to navigate through the three dimensional Hipparchos star catalog. The *StarFlight* exhibit built on that application by including introductory movies, sound narration, guided tours and a simple user interface, to create an application suitable for non-guided use in a museum by non-scientists.

The script was written to guide the viewer through the visual journey, highlight any relevant astronomical principles, and inform on the mythological basis of the constellation forms. The mythology was researched using several references (see below). Each constellation tour script went through several stages of rewrites to ensure optimum flow and length, as well as incorporate the reactions of the evaluated audience members and their feedback.

## ***Evaluation***

### *Front End*

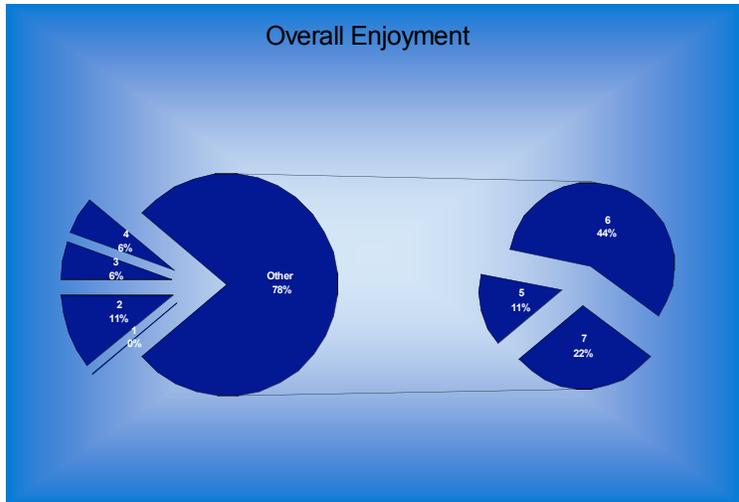
We designed a front-end evaluation to determine popular knowledge of two astronomical subjects: (1) the Solar System, and (2) common constellations. The form of the evaluation was an open-ended discussion where we asked people to draw the Solar System and any constellations they could remember, and then explain what they drew. We collected 10 interviews during one afternoon at the Museum of Science and Industry. Our general conclusions were that most people interviewed knew some basic facts about the Solar System and the Constellations, but many people had incomplete understandings of the relationship between different objects in the universe. For example, a respondent who knew that the Earth revolves around the Sun, might also incorrectly believe that the constellations lay inside the Solar System. We therefore decided that an exhibit illustrating the distance relationships between different objects in the universe would have an impact.

### *Prototype*

Once a working prototype was created, an evaluation session was performed at the Museum of Science and Industry. Several large groups were facilitated through the evaluation area, allowed to interact with the program, observed during interaction, and asked to complete a short survey following their time with the program. In total, there were 18 survey respondents.

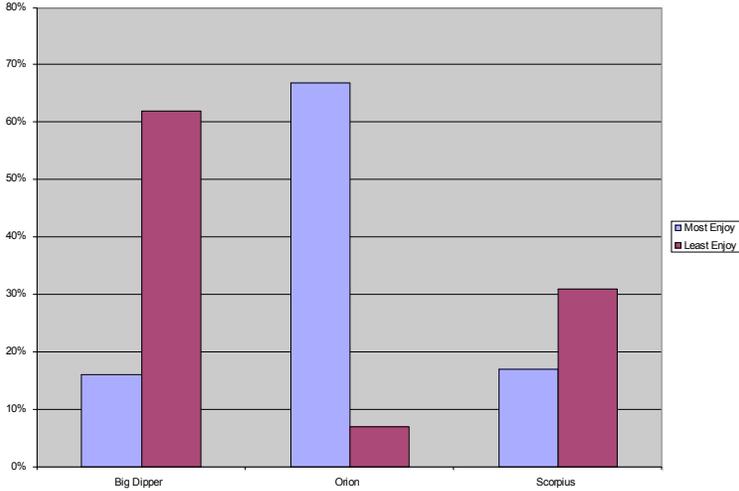
Overall, the program was very favorably received. The atmosphere during the evaluation was imbued with excitement. A few of the large groups turned the manual flight into a game, cheering loudly when their peer found the way back to the sun and yelling out suggestions when they were lost. Smaller groups, consisting of two or three individuals, spent as much as ten minutes manually flying through space or repeating the constellation tours. During the two hours of participant evaluation, the room was often filled with laughter.

The survey results indicated a similar response. Seventy-eight percent of the respondents gave an above “fair” rating (at least 5 out of 7) and twenty-three percent denoted an “excellent” rating, the highest (7 out of 7). These results can be seen below in Figure 6.



[Figure 6]

The respondents also indicated the most enjoyable and least enjoyable constellation tour and their reasons for this opinion. At the time, the narrative scripts for each tour differed, with each emphasizing a different feature. The Orion tour highlighted mythology, the Big Dipper tour focused on astronomical information, and the Scorpius tour merely guided the viewer through the distortion occurring during flight. Orion was by far the most liked, with sixty-seven percent marking it as their most enjoyed tour. Only one respondent indicated they did not enjoy this tour. The incorporation of mythology was the most stated reason for this high enjoyment, as well as its familiarity and the ease at which it can be identified in the night sky. The Big Dipper was the least liked, with a sixty-two percent unfavorable response and seventeen percent favorable. Those who provided a reason for either preference both specified its familiarity as the explanation for their opinion. (So it was both liked and disliked because it has such large exposure.) Scorpius was mostly marked as disliked; respondents stating that it was long and confusing. (In fact, it was the shortest tour in time length.) The results of this portion can be seen in the graph below, Figure 7.



[Figure 7]

The evaluation process yielded helpful insights which were further built into the overall design of the program. The scripts for the Big Dipper and Scorpius tours underwent large changes to incorporate the mythology. The Big Dipper tour was completely altered to the actual constellation of Ursa Major, though the Big Dipper is still mentioned. To facilitate space navigation, a “consul” was added to the bottom of the screen to indicate speed (at ‘x’ million times the speed of light), distance from the earth (in light-years), and position of the sun (in relation to the point the user is at in space). Furthermore, background music was added and the introduction lengthened to explain the origin of constellations. Other technical issues were also confronted and resolved.

### ***Credits***

#### Opening Animation

Lance Long, Electronic Visualization Laboratory, University of Illinois at Chicago

#### Special Thanks

Brett Nicholas & Brian Wunar, Museum of Science & Industry, Chicago, IL

Carina Eizmendi & Ronen Mir, SciTech Hands-On Museum, Aurora, IL

Robert Kooima, Electronic Visualization Laboratory, University of Illinois at Chicago

Brian Abbott, American Museum of Natural History, New York, NY

StarFlight is an interactive 3D virtual reality exhibit developed by the MSCOPE at the University of Chicago’s Center for the Presentation of Science.

MSCOPE Principal Investigator, Leo P. Kadanoff

### ***References***

H.A. Rey, Find the Constellations. Houghton Mifflin Co. 1977 (1954).

H.A. Rey, The Stars: A New Way to See Them. Houghton Mifflin Co. 1976 (1952).

[www.comfychair.org/~cmbell/myth/myth.html](http://www.comfychair.org/~cmbell/myth/myth.html)

[www.windows.ucar.edu/mythology/stars.html](http://www.windows.ucar.edu/mythology/stars.html)

[www.astro.wisc.edu/~dolan/constellations/constellations.html](http://www.astro.wisc.edu/~dolan/constellations/constellations.html)

[www.dibonsmith.com/constel.htm](http://www.dibonsmith.com/constel.htm)

[www.wikipedia.org/wiki/Constellation](http://www.wikipedia.org/wiki/Constellation)