

Stargame

an interactive GeoWall exhibit for teaching basic astronomy

a Big Project Proposal by

Timothy Donaghy, Staci Willis, Brent Sackris, Panos Oikonomou

Introduction

I propose to implement an exhibit designed to teach basic concepts in astronomy. The general plan is to create a guided, yet fully interactive, presentation for the GeoWall at SciTech. The GeoWall has been used for some very cool scientific visualizations, and my vision is to develop a way in which the power and excitement of using the GeoWall is directly experienced by the 6 to 12 year old kids who visit the museum. Although the exhibit will be guided, the ideal is to put the controllers in the hands of the kids, so it is not a passive experience.

The Big Idea underlying the exhibit is to learn how the brightness and size of stars changes depending on how near or far from the observer they are. In scientific terms, the goal is to qualitatively understand the inverse square law and how astronomers use light to study very distant objects such as stars and galaxies. In lay terminology, the goal would be for the students to gain an intuition for the fact that objects emitting light appear fainter and smaller as they get further away, and vice versa. A secondary goal would be to introduce some basic astronomy terminology: stars, planets, binary stars, nebulae, galaxies, etc.

The implementation of the Big Idea is to create a video game style interaction where the students get to navigate through a 3-dimensional star cluster. The impetus for doing so is to solve a puzzle and thereby travel around the star cluster. At each step, the participants must decide where to travel next based on a clue about the stars and other objects they see. For example, they might receive a clue that their next destination must be to the third closest star system from where they are now. The students then have to make a decision based on what they've learned and the context of what they see.

Basic Storyline

The basic outline of the game to be played on the GeoWall is a semi-guided tour of a cluster of stars and other interesting astronomical objects (perhaps an actual dataset). The game consists of a series of steps where the participants have to choose where to travel next by answering a specific question. The questions will be a way of introducing astronomical terms (star, galaxy, planet, binary system, nebula, red giant, etc.) and get them thinking about ideas like "brightness" and "distance."

Another example might be, "The object in your quest can be deep inside the nebula shaped like a horse." Then the participants would have to judge what that means and

then choose where to go. If they choose correctly they zoom off to their next destination (while seeing the sights along the way, and perhaps doing some autonomous exploring if they want); if they guess wrong, then a definition or a tutorial would pop up and then they would get a another chance to choose. The game should also have an interesting narrative as a basis for the galactic scavenger hunt we're sending them on, perhaps something about recovering lost scientific data, a voyage of exploration, or even putting together a powerful weapon to fight off the alien invaders.

Simply interacting with the 3D environment of the GeoWall will help build an intuitive understanding of notions of brightness and distance in astronomy, such that we don't need to be explicit about the inverse square law. There are actual astronomical datasets that could be used for this, but it is more important to make the visual experience densely packed with interesting things to see than to faithfully represent outer space (which is, after all, mostly empty). That is, the stars and nebulae and planetary systems that we will fly by should be interesting to look at upon close inspection.

Evaluation Plan

Since fully implementing this project will likely take a large effort, it will be important to evaluate the feasibility of the project early on in the development. One option for a front-end evaluation would be to evaluate the current GeoWall offerings at SciTech to understand what works and what doesn't, and to assess whether a more interactive approach would be feasible. I propose to interview museum visitors who have participated in the current GeoWall exhibit to evaluate this prospect.

When a working prototype of the exhibit is constructed, it will be essential to perform some beta testing on visitors of the right age group. Evaluation at this stage will seek to determine if the interface is easy to use and whether the game setup is compelling. Observation and targeted interviews with a small group of participants who have used the exhibit will be the method.

Educational Impact

This exhibit will likely be more educational for older children in SciTech's audience (9-12), but may also be interesting to younger visitors. The exhibit contributes to the following goals from the Illinois State Board of Education Science Learning Standards for students from early elementary school through middle school.

Early Elementary School

12.F.1a Identify and describe characteristics of the sun, Earth and moon as familiar objects in the solar system.

Late Elementary School

12.F.2c Identify easily recognizable star patterns (e.g., the Big Dipper, constellations).

Middle/Junior High School

12.F.3a Simulate, analyze and explain the effects of gravitational force in the solar system (e.g., orbital shape and speed, tides, spherical shape of the planets and moons).

12.F.3b Describe the organization and physical characteristics of the solar system (e.g., sun, planets, satellites, asteroids, comets).

12.F.3c Compare and contrast the sun as a star with other objects in the Milky Way Galaxy (e.g., nebulae, dust clouds, stars, black holes).

Implementation

Since SciTech already has a working GeoWall, the primary hardware development will be creating a hand-held controller similar to a video-game joystick. Software development will include creating the 3D space, populating it using available datasets, testing the hand-held interface and writing the game software.

Fall-Back Option

In the event that an interactive GeoWall exhibit is impractical to implement, there is a natural fall-back option. Constructing a non-interactive GeoWall exhibit that gives a guided tour of some interesting astronomical data sets and provides a good introduction to the notions of brightness and distance of stars we see in the sky, would be easy to create out of the visualizations and datasets already in place.