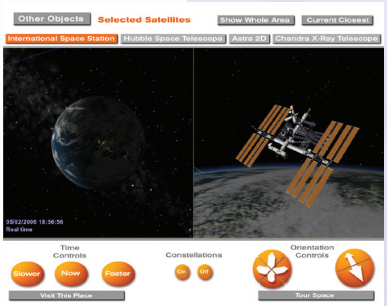
project faraday
exemplar designs for science

GovEd Communications Consortium



GovEd Communications

Springboard Design Partnership

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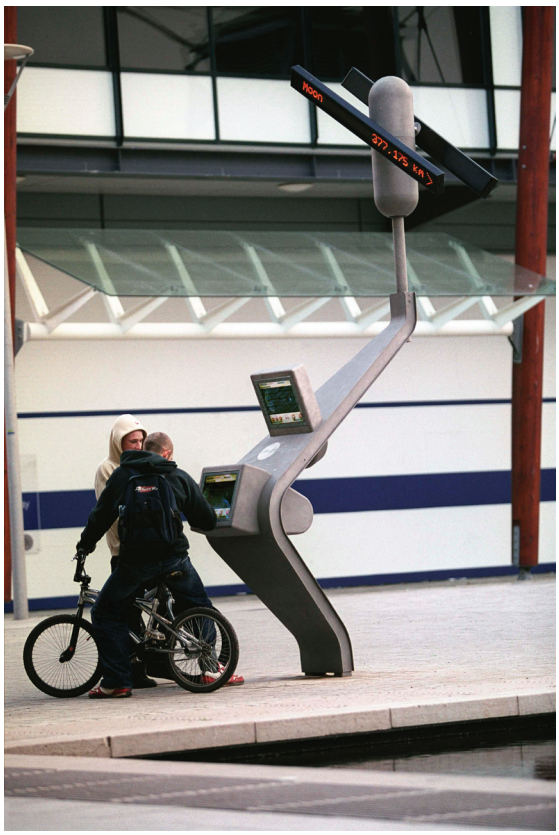
Introduction

Space Signpost transforms the way learners engage with the cosmos. It offers a unique combination of virtual and physical interaction.

Space Signpost is an idea developed by the GovEd Communications consortium as part of Project Faraday. The consortium comprises GovEd Communications, Alligan, Feilden Clegg Bradley Studios, Futurelab and Soda Creative. Springboard Design Partnership were sub-contracted to provide design expertise.

Conents



The Space Signpost in Millennium Square, Bristol is the result of a two-year long collaboration between Adam Nieman and Futurelab. The signpost is popular with all sections of the community – especially with young users of Millennium Square, who were initially considered a threat to the project because of fears of vandalism.

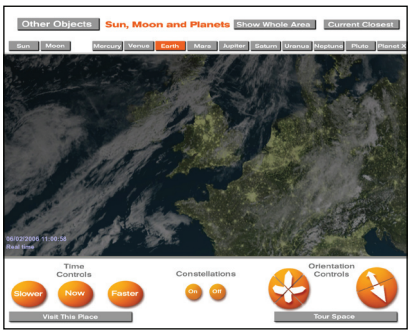
Background notes

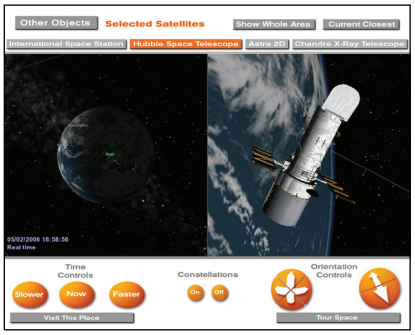
Space Signpost is a development of an idea originally conceived by GovEd Communications' creative director and developed in collaboration with Futurelab. The project was born out of the desire to enable people – ordinary people going about their everyday lives – to feel part of space, The development involved extensive research with a wide range of users.

Since the launch of the first Space Signpost, in January 2006 in Millennium Square in Bristol, browsers have had the opportunity to chart their own paths through the cosmos, bringing the solar system closer to home with real time information and easily understandable analogies available via a touch-screen interface.

How far am I from Mars? Which way to Venus? Users generate their own enquiries – rather than being led on a pre-determined path – and the signpost swivels to show the direction in which their chosen planet lies at that precise time, the exact distance to it, which also gives an indication of how fast it is moving.

Space Signpost supports users' own exploration of the Cosmos and makes engagement with astronomy easy and natural. Thanks to Project Faraday, this unique way of engaging with science can now support a range of teacher-led and student-led approaches to the subject.





Space Signpost: Description

Space Signpost lets learners explore space in real-time and on their own terms. They can navigate the entire universe (to the extent it has been mapped); view planets in real time with all the detail available to planetary science; speed up time and view solar system dynamics from any angle. In schools it can play a number of roles. It can support specific lessons in a very focused way and/or act as an ever-present resource for casual engagement, supporting learners own developing relationship with the Cosmos.

There are two aspects of Space Signpost that can be used independently or in combination:

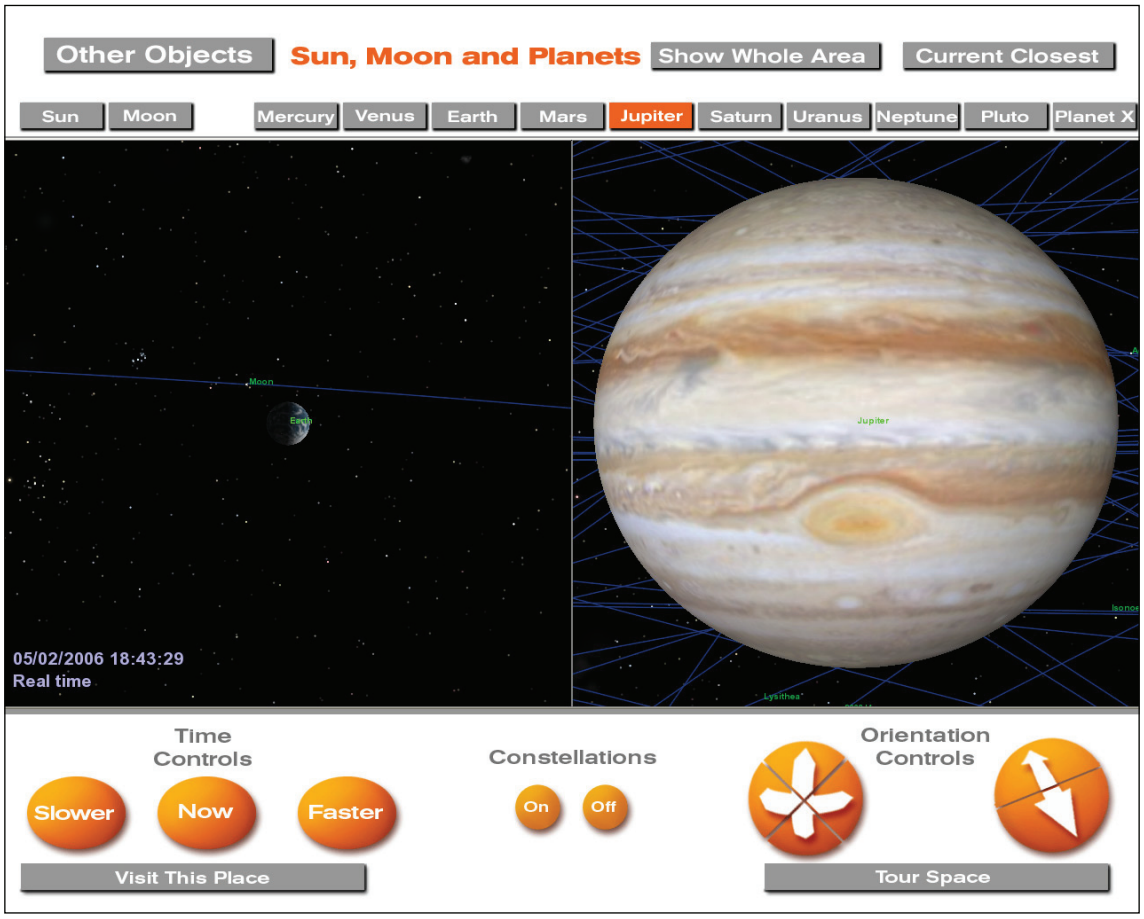
1. A physical signpost, and
2. Interactive software

The software accurately models the dynamics of objects in space, be they low-orbit satellites or distant quasars. The system then needs just two pieces of information to locate the objects and display them correctly: it needs to know what time it is and the coordinates of the signpost's physical location. A teacher can decide which objects to focus on (planets, stars, satellites, etc.) and can generally control the user experience.

Space-science and astronomy pose particular problems for science education. For some students they are the most exciting and inspiring parts of the curriculum, but other students find astronomy abstract and irrelevant. For both sets of students, space science and astronomy can generate counter-intuitive results, which can make the subject difficult.

Space Signpost makes two important contributions. First it makes the subject concrete by referencing celestial objects as they appear now, in relation to the students themselves. Secondly, it supports students' own exploration allowing them to a) pursue answers to questions that the system provokes in them personally and b) spend more time on aspects they find conceptually difficult.

The system literally offers students the whole universe, but it is not always appropriate to provide such wide scope. Therefore, the interface can be easily modified to focus on particular aspects of space science. One day the focus may be on the evolution of stars, the next it may be on relations between Sun, Moon and Earth. All the objects can be linked to existing multimedia content that may include simple notes prepared by a teacher or complex resources developed by NASA.



The most usual arrangement of the interface provides access to a wide range of solar system objects. On selecting an object (in this case Jupiter) users are presented with a view that provides as much information as possible but does so in a way that minimises confusion. In this case, a view of Jupiter is presented from a fixed distance in the direction of Earth (this is what Jupiter looks like right now) and this is compared with a view of the Earth from the same distance in the direction of Jupier. Users can zoom into the object and explore its surface with easy to use controls. They can also control time and watch patterns of rotation and orbit. The 'visit this place' and 'tour space' buttons provide links to additional multimedia content.

User Interface Development

The Space Signpost software was developed in collaboration with users themselves and built on top of the most sophisticated space simulation software available (Celestia). Although its value in schools been demonstrated through earlier prototypes, the present development work will improve the software's flexibility and give teachers total control of the user interface.

The main differences between the Space Signpost software and any other astronomy program (including Celestia) are that:

1. users require no training at all, (made possible through considerable research and co-development with users);
2. the program is totally customisable.

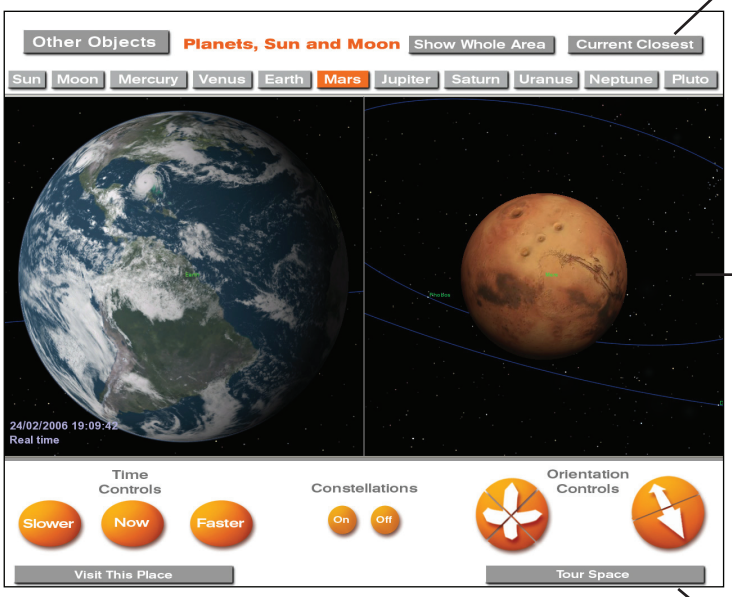
The current software works well in schools as it stands. It is easy to use and the existing 'content' (e.g. information about Mars) is a good starting point. There are very few limitations with the current software – it is amenable to modification and customisation. However, there is room for improving the range of ways teachers and learners can interact with the software and the ease with which it can be customised.

Current user interface

The current user interface was designed with the following priorities in mind:

- It must be immediately usable (without training)
- It must support users whose understanding of astronomy may be very confused
- It must provide access to the range of astronomical objects that users expect it to
- It must be possible to modify the interface without re-compiling the program

The current interface divides the screen into three parts: a selection area, an interaction area and the main 3D display.



selection area

main 3D area showing selected object. In this view, Mars is shown as it currently appears from the direction of Earth and Earth is shown for comparison on the same scale as viewed from the direction of Mars.

interaction area

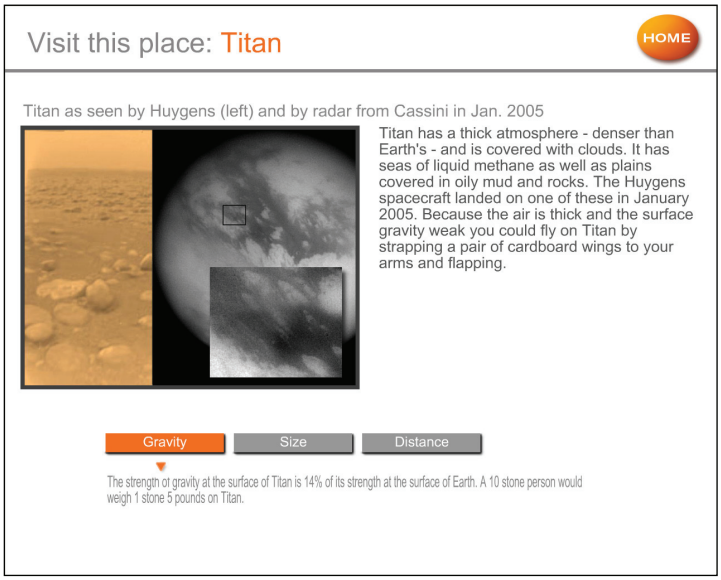
The selection and interaction areas run in an instance of Internet Explorer, which means they can be constructed as easily as a web page and can exhibit the full sophistication of a web application. (Detailed documentation for interface coding is available with the application itself.) Links to further information (such as the 'visit' and 'tour' sections)

Selecting an object (from the selection area) causes the signpost to point to that object and also a 'script' (a set of instructions) to run in the main program. The script ensures that what the user sees on the screen is as direct and informative as possible and avoids any views that may cause confusion. The scripting language can determine, for instance, which objects are labelled, which orbits are visible, how fast the user 'flies' through space, etc.

The scripting language (a variant of Lua) is simple enough for non-programmers to get to grips with. Nevertheless, we do not anticipate fine-control of the user experience being something that the general users will ever have any reason to involve themselves with. There are scripts prepared for the full range of selections that users may make.

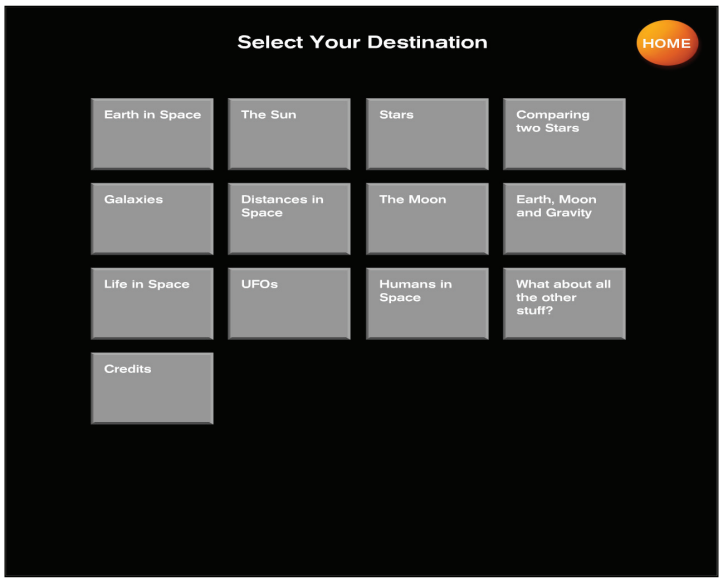
The current interface also provides links to 'external' information. In its current incarnation there are two main parts to the external multimedia content.

One: Pressing the 'visit' button provides users with a description of the currently selected object. These descriptions include the kinds of details that users showed interest in during user testing. Customising this content is relatively straightforward.



Example of the 'visit this place' content: Titan (moon of Saturn)

Pressing the 'tour' button takes users to a specially developed multimedia 'text-book' that provides explanations of astronomical phenomena. It is designed specifically to support users who may have confused ideas about space (which includes all of us) and to answer questions that arise spontaneously through the use of the signpost and software.



Selection of topics covered in the 'Tour' – the content that supports users in answering questions for themselves and resolving confusions

Example of content from the Tour, in this case from the 'Moon' section

Next steps for the user interface

The current user interface provides a pre-selected collection of objects for users to interact with. It is also designed for general use rather than being optimised for specific uses (e.g. explaining eclipses or the threat from 'Near Earth Asteroids' or identifying extra-solar planets). The new user interface makes customisation easier and also supports sharing and cooperation amongst users.

The goal of the new user interface is to simultaneously make the program more flexible and more focused. It achieves the former by allowing users to select any object in the system and achieves the latter by offering different ways of organising the objects, the external material they are attached to and the behaviour of the system on selection of the object.

As explained above, controlling the behaviour of the system is achieved with scripts

- Lists of objects organised by type (galaxies, stars, planets, asteroids, spacecraft, etc.)
- Customised lists of objects (e.g. stars grouped by spectral type)
- Lists can be expanded or contracted with the click of a mouse
- The scripts (screen behaviour) that objects are associated with can be switched
- Settings can be stored and shared (e.g. so the interface can be switched from one set up for year 4 students to explore the Moon to one set up for year 13 students to explore planetary nebulae with a click of a mouse)

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