



**ROYAL INSTITUTE
OF TECHNOLOGY**

An Interactive Visualization of the Sun

Assignment 2

Group 5

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Introduction

Information Visualization is concerned with presenting information in such a way that is easily and effectively comprehended by humans. The basic intent of effective information visualization is to present huge amounts of data in such a way that the user can easily view and understand it.

In the first course assignment we presented our work in the form of static images. Use of graphical interfaces naturally suggests a more interactive and visually stimulating interface that the user can manipulate according to his/her own interest and wish. This interactivity enables the user to navigate through a larger pool of information using that interface.

With the availability of powerful monitor screens and advancements in graphic displays, the use of interactive visualizations has become more common place than ever, yielding a science of Human Computer Interaction in itself.

The purpose of this assignment was to demonstrate the life and death of a star through designing an interactive application which shows its birth, life, death and the physical and chemical processes that influence these stages and transmissions between them.

For this assignment we chose "Sun" as our star of choice to visualize. We demonstrated its five life stages namely, nebula, protostars, red dwarf, supernova and finally black hole.

We created the application for a general user who might be interested in finding some information about the star. The reason for keeping it simple is that we used Macromedia Authorware 7.0 for our design and it was our first experience with the software. Time constraints limited the scope our project as most of the time was spend learning the software. However, we improved the quality of visualization after each presentation as we got a feedback from the potential users and we tried to incorporate as much as possible into it.

This report sheds light on our work with respect to the theoretical concepts we learnt during course. We also explain how we went about creating the system and the difficulties we faced and finally the conclusion.

Theoretical Background

A good and effective visualization is more than just a static picture and a 3D virtual environment in which a person can walk around and inspect like a museum full of statues. Infact a good visualization is something that allows us to drill down and find more data about anything that seems important. Ben Shneiderman has called this *visual information-seeking behavior* and the interfaces that support it: *Mantra*:

"Overview first, zoom and filter, then details on demand," (Shneiderman, 1998).

We tried to present information about the life stages of planet Sun in the same way in that the user is given an overview of different stages of life cycle first in the form of a 2D diagram. And then if the user wants to know more about a particular stage, he/she can be navigated to more detailed information.

In our assignment, we tried to make everything in the visualization interactive in that a user is able to interact with them that enhance his/her thinking processes:

"Ideally, every data object on a screen will be active and not just a blob of color on the screen. It will be capable of displaying more information as needed,

disappearing when not needed, and accepting user commands to help with the thinking processes". [1]

Interactive Visualization is a process made up of a number of interlocking feedback loops that fall into three broad classes:

- ✓ *Data Manipulation Loop* - For the selection and movement of objects using the basic skills of eye-hand coordination.
- ✓ *Exploration and Navigation Loop* - Through which an analyst finds his or her way in a large visual data space.
- ✓ *Problem-solving Loop* - Through which the analyst forms hypothesis about the data and refines them through an augmented visualization process.

An effective interactive visualization is one that behaves as a *problem solving system*. In our assignment we tried to make the visualization such that it supports the user to effectively navigate through the environment and find the relevant information.

"In some ways, an interactive visualization can be considered an internal interface between human and computer components in a problem-solving system. We are all becoming cognitive cyborgs in the sense that a person with a computer-aided design program, access to the Internet, and other software tools is capable of problem-solving strategies that would be impossible for that person acting unaided". [1]

The most important characteristic of an effective interactive visualization is its ability to give appropriate feed back quickly. This is called the *Principle of Transparency* and in our assignment we tried to incorporate that as well.

"In the data exploration interface, it is important that the mapping between the data and its visual representation be fluid and dynamic. Certain kinds of techniques promote an experience of being in direct contact with the data. This is called the principle of transparency". (Rutkowski, 1982)

Implementation

The implementation was carried out using Macromedia Authorware 7.0. It is a visual authoring tool for creating rich-media e-learning applications for delivery on corporate networks, CD/DVD and the Web. Macromedia Authorware also follows the learning management systems (LMS) standards.

In order to develop the interactive interface we came up with a very simple idea. The user is presented with a Main Menu when the application is loaded. This menu displays the gist of the whole application. On the top right corner, there are global navigation buttons like Menu and Quit, they appear in every interface throughout the application. On the top left is a description of the current menu. The items of the main menu represent the different stages within the lifecycle of the star. The user is free to use either the keyboard or the mouse to access each sub-menu.

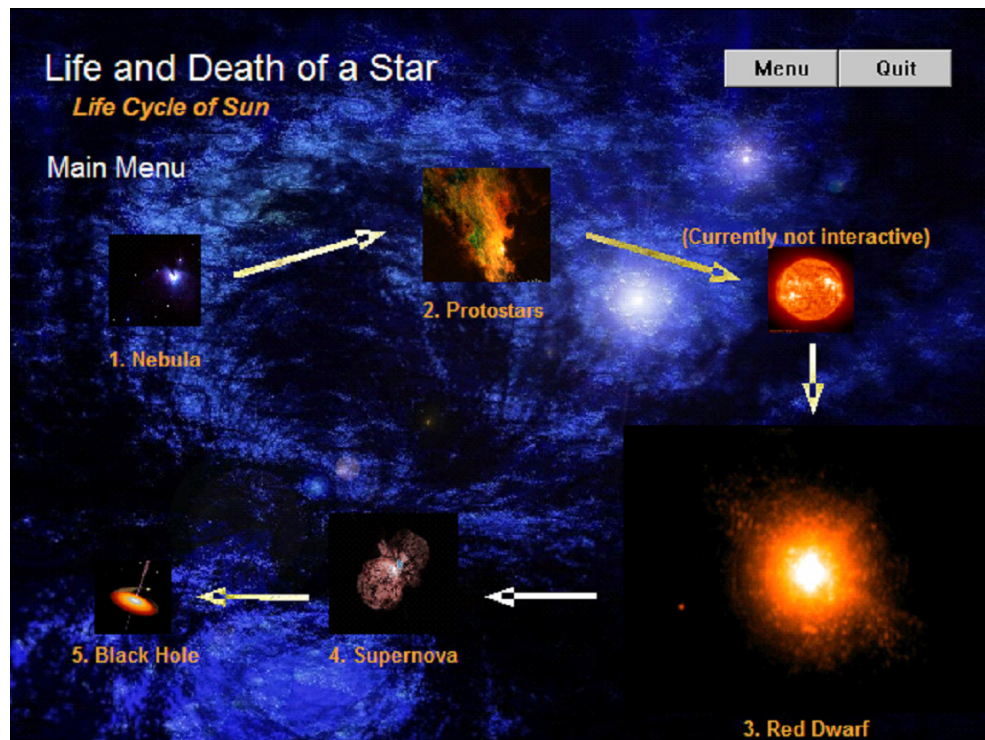


Figure: Main Menu

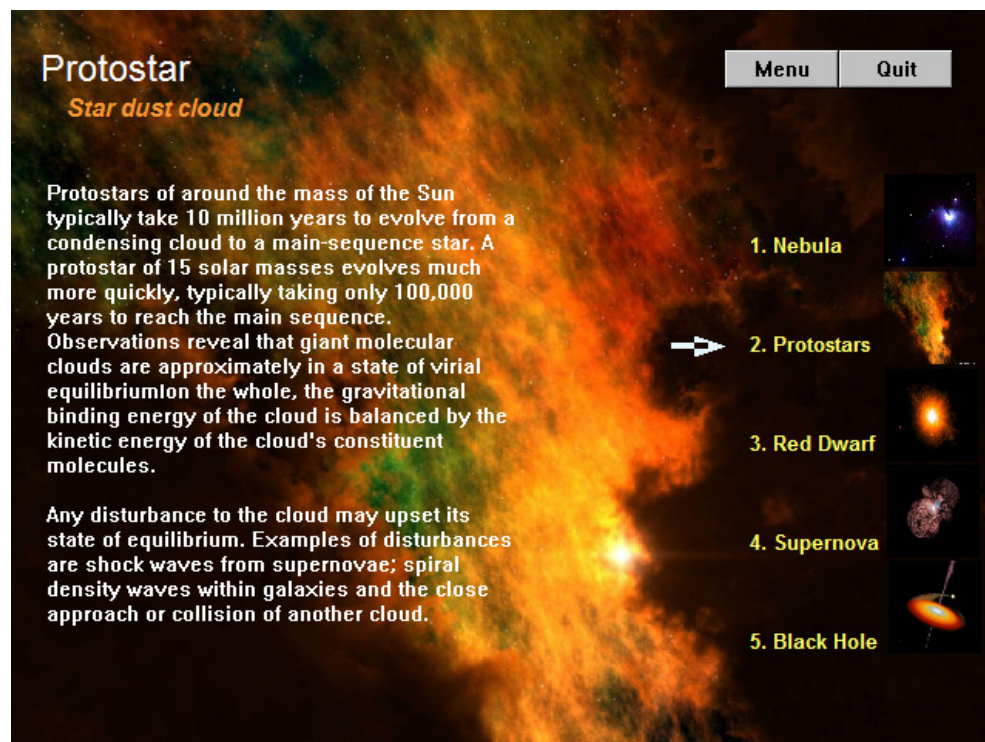


Figure: Protostar Sub-Menu

We have defined hotspots over each image on the screen to make it interactive. Upon clicking any item on the menu, the user is taken to that menu where the interface outlook changes. The background is loaded with the image of the icon he/she just selected and a new navigation mechanism is loaded onto the right

hand side of the interface. This is there to help the user understand his/her location within the system. It also provides sequential and non-sequential access to different lifestages of the star depending on which icon the user wishes to click.

We created a different background for each type of menu and saved them as a library for our application.

Future Work

The work on this is by no means finished as we learnt from both the theory and through our experience with the presentations. Interaction designing is an iterative process and it constantly needs to be evaluated and updated according to changing user needs and demands. We found it to be the biggest challenge during the design, how to cater to changing user needs? The partial answer we came up with was to define our intended audience first. It makes the life of the designer much easier.

Following are a few things that can be improved in our system and which would broaden its appeal to more technical users as well.

- ✓ Visualization of parameters that vary across each lifestage of the star. For example, temperature, humidity, time for lifestage, size etc.
- ✓ Interactivity within the sub-menus by adding hotspots on the sub-menu background to make it more interactive to interested users.
- ✓ Scrolling ability for the displayed information in each sub-menu.
- ✓ Adding animations wherever found feasible.

Conclusions

Designing of an interactive visualization and GUIs in general is an iterative process and it must involve the end user. We, as the designers of the system were unaware of range of problems that were pointed out and highlighted during our presentations.

Interactive visualizations give the designer a lot of room to create highly informative interfaces where a user may be presented as much information as he/she desires and relieves some of the compromises that have to be made in making 2D static drawings. However, it introduces a new set of problems for the designers where the visualization has to grab the attention of the user and each active object on screen has to portray the right affordance. For example, an interactive button and hence its feature can completely be missed out if it doesn't give the right affordance.

In designing interfaces where navigation is easy, there is a tendency for the user to get lost in hyperspace and lose track of the task at hand. Therefore, providing global navigation and awareness is also one of the challenges of designing an interactive visualization.

References

1. Information Visualization by Colin Ware: Schneiderman (1998).
2. Spence Robert: Information Visualization-Wesley, ACM Press 2001.
3. Ware Colin: Information Visualization – Perception for design. Morgan Kauffman Publ. 2004.