

# Logo goes 3D

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**Abstract:** This paper presents work underway to create a version of Logo that is on-line, 3D, multi-user, and distributed over the Internet. The potential of this approach is to create on-line 3D environments to produce engaged participatory learning experiences for students at a distance. The vision is to develop a system that would allow one or more students to come together on-line over the Internet and share a programmable object that uses the Logo language and interact with the object in a 3D space in a collaborative fashion. We are currently developing an application based on the Created Realities Group distributed learning system.

## Introduction

The concept of Logo to support constructive learning has been in existence since the 1960's. Logo as implemented in computer software in the 1970's has focused on either single student to single computer or a group of students sharing a single computer. Later versions of Logo have supported multi-user networking, but have not truly provided a shared learning environment where students using single computer systems at distant locations can work together and view each others work.

We are developing a 3D application based on the Created Realities Group (2002) distributed learning system that would combine Logo concepts with on-line 3D environments to create engaged participatory learning experiences for students. The vision is to create a system that would allow one or more students to come together on-line over the Internet and share a programmable object that uses the Logo language and interact with the object in a 3D space together. Personal computers being used today in K-12 classrooms/labs support the necessary hardware and Internet connectivity to support this concept. This approach could expand Logo so that it can allow classrooms connected by the Internet to simultaneously engage in K-12 projects about mathematics, language, music, robotics, telecommunications, and/or science.

## Moving Logo towards a Collaboratory/Participatory Shared Learning Experience

The potential now exists to combine on-line immersive interactive systems with collaboratory/participatory shared learning models that can be used in most schools in the United States. These types of systems would allow students in the same classroom or in different classrooms to work together to construct knowledge through participatory environments. Logo is one such approach that could be placed into this type of system to allow students to view each other's work at the same time and to develop programs in a group setting.

On-line collaboration systems are not new. MOOs (Multi-User Object-Oriented) have been used for learning, training, and collaboration since the early 1990's. The MIT Media Lab demonstrated that virtual meeting spaces have significant potential for training and collaboration (Bruckman, 1992). The first wave of 3D graphical MUDs (Multi-User Domains) began in 1999 with the release of Everquest developed by Verant (Sony, 2002). 3D environments are more commonly seen today in computer games. Personal computers that support the ability to display 3D applications are no longer a barrier to access. In 2002, more than 221 million computer and video games, many 3D based, were sold in the United States, or almost two games for every household in America. Many do not realize that the sale of video game software in the United States represents a \$6.9 billion industry (Essential Facts, 2003). The same technology that allows an immersive experience presented in a game context can be harnessed to present learning spaces to an ever-growing population of people that have computers with built-in 3D graphics capability.

This project is an outgrowth of our research and development of an on-line educationally based 3D learning environment. After working with various 3D engines that are open source or commercially available, we found that they either were not flexible or were too orientated towards producing a game as the final outcome. This was natural, since the developers and programmers of these systems are doing it in support of their gaming interest. We began to develop what is now called Created Realities Group Distributed Learning System in 2001. The Created Realities Group (CRG, 2003) has created a 3D client/server system that is focused on supporting distributed learning. The system supports collaborative tools (audio chat, text chat, overheads, etc) that reside in a 3D environment. The created realities concept is to take current off-the-shelf commercial approaches that provide contextually accurate software-derived 3D environments and then overlay collaborative groupware, unified communications, and other instructional tools to create a single distance/distributed educational delivery interface. Figure 1 shows a screen shot of the college/university environment.



Figure 1 – Screen shot of College/University 3D environment

The CRG system is designed to support plug-ins that allows its capabilities to be expanded. The first expansion beyond the course delivery tools was to place the planet Mars on-line using data from the NASA MOLA project. Figure 2 shows a screen shot of the summit of Olympus Mons. The expansion allowed us to put over 2 Gigabytes of information detailing the face of Mars into the on-line system so that students could tour the face of Mars in real-time (CRG Mars On-Line, 2002). Students are able to login and move around and discuss what they are seeing of the face of Mars. After we finished the Mars development, it was only natural to think about how Logo might be changed when placed in a 3D environment. Such that a student might program a Mars rover using Logo to explore surface of the 3D Mars environment or students working together in on-line groups to program larger object interactions.

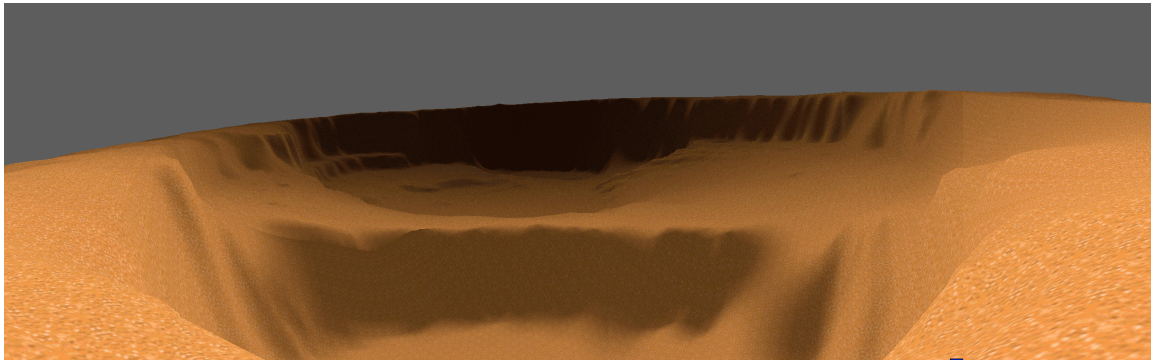


Figure 2 – Example of the Mars 3D environment generated in real-time based on NASA MOLA data.  
Panorama Shot of Olympus Mons, Top Cone (MARS\_19.0\_227.0).

## Logo 3D

As mentioned at the start of the paper, the concept of Logo to support constructive learning has been in existence since the 1960's. Today, several companies support Logo-based applications that are used in the classroom. One popular application used is Microworlds developed by Logo Computer Systems, Inc. (LCSI Microworlds, 2003). Up till now though, Logo has taken place on a flat plane. One of the challenges of this project is to move Logo from a 2D space into the 3D domain. The basic commands work well, but some commands do not translate well to a 3D environment. Our first version uses the basic commands available to the language. Several new commands are being added to allow the turtle (or any other image you want) to move and rotate in the 3<sup>rd</sup> dimension.

Figure 3 shows a screen capture of the initial prototype development. What was the most intriguing outcome of this prototype was the feedback we got from people interacting with the presentation of the information. The balls and lines represent solar systems connected by different types of faster than light travel (sci-fi gaming concept). We had people, who were interested in the mock game concept, log into the 3D environment and then were asked questions about distribution of lines (jump gat technology) to balls (solar systems) through the audio and text chat features. As we asked question and the participants gave feedback we would change variables in the script and then redisplay the model. People were very engaged with the model, because they could interact with it by moving around and through the model while it was being generated and at the same time discuss the topic with audio or text with other participants. It would have been that much more powerful is the participants could have been able to share control of the script as a group. The prototype has given us good feedback and is driving aspects of the current design.

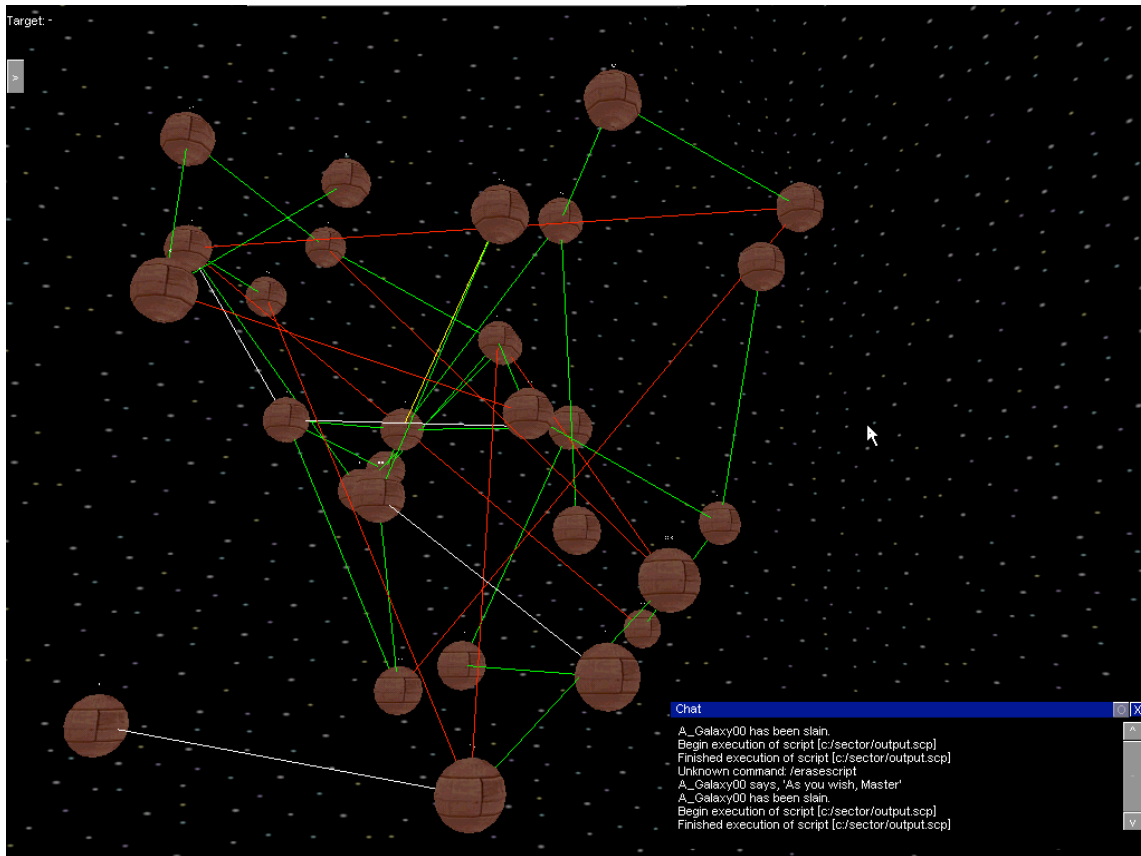


Figure 3 – Screen Capture from the Logo3D prototype.

## Conclusion

We are looking forward to moving ahead with this development. Before we can complete the first version of the Logo3D project, several enhancements to the CRG core system are required. We are in the midst of those changes now and hope to complete them in the coming months. Once these new elements are in place within the CRG core system, it is our goal to have the first version of Logo3D expansion module development completed. Educators and Logo enthusiasts interested in this project should contact the authors for more information.

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