



# Approaches Using Virtual Environments with Mosaic

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## ABSTRACT

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This paper describes two ways to use a computer generated environment with Mosaic. Two approaches are taken. The first is to allow the user to interact with an environment displayed as part of the Mosaic document, an in-line image. The second is to create an independent process with which the user can have high bandwidth interaction, i.e. real time manipulations, which can drive Mosaic remotely.

In the first case an in-line picture of a space can be “walked-through” by allowing the user to select buttons which move the point-of-view of the user forward, backward, left or right. Each user selection causes a network request to the Mosaic server which renders a new scene and/or loads a new HTML page. This method has the advantage of being a pure Mosaic application and issues of portability are minimized, however at the cost of performance.

Using the second method, creating an independent process, a user is allowed to interact with a graphical process running on the user’s workstation. At appropriate times in the interaction the user selects an object. Objects can have a URL associated which causes the Mosaic process to go to that URL using the remote control facility in the X version of Mosaic. This method allows the user to have a great deal of interaction in real time with dynamic feedback. However issues of portability become more important, as the real time graphics process may be dependent on the particular platform.

These techniques demonstrate that the use and interaction with spatially oriented information spaces are practical. Both techniques have advantages and disadvantages which are discussed.

Certain trade names and company products are mentioned in the text or identified in an illustration in order to adequately specify the experimental procedure and equipment used. In no case does such identification imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products are necessarily the best available for the purpose. This work described was funded through the U.S. Government and is not subject to copyright.

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## 1.0 Background

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Mosaic, the first Internet “killer application”, has brought the Internet into the popular culture. Users can begin to use simple point and click interfaces rather than a myriad of arcane commands and protocols. As another step towards a more natural interface we propose to use a first person point of view (POV) model which allows a user to interact with information in an intuitive manner.

Surrogate travel has been around in a graphical form for over 15 years. The concept of first person POV has been used to convey a sense of place to a user interacting with a computer. The nature of the interaction has varied quite a bit depending on the context of the application. In the late seventies the “Aspen Movie Map” work at the Architecture Machine Lab (now known as the Media Lab) at MIT pioneered the concept of real time surrogate travel with photo realistic images [Donelson] [Lippman]. The movie map work was extended to the use of these environments as front ends to information [Bolt] [Herot].

More recently Apple Computer is in the process of commercializing the concept of first person POV interfaces with QuickTime VR [Quinlan]. Travel though an abstract space such as a hierarchical file system has been demonstrated with Silicon Graphics’ FSN [FSN].

Examples of first person POV interfaces come from many domains. Games such as 7th Guest, Myst, and Jurassic Park (popular games on PC, Mac, Nintendo and Sega platforms) all allow the player to travel in a first person POV manner. Information organizers such Packard Bell’s Navigator[Newsbytes] and Apples eWorld[Mossberg] interface to on-line services all use a first person POV metaphor to organize information and give users a sense of place and structure.

One effort in particular, the call for the creation of VRML (Virtual Reality Markup Language) has stimulated a number of efforts to link virtual environment to the World Wide Web (WWW). A number of interesting language proposals [Labyrinth] and demonstration systems [WebOOGL] can be found at the VRML [VRML] site.

Coupling virtual environments with Mosaic and WWW is only the next logical extension to these spatial types of interfaces. Mosaic provides a uniform interface to the Internet and WWW. Virtual environments combined with Mosaic should lead towards more intuitive user interfaces.

Integration of a virtual environment with Mosaic can take two forms the in-line graphics or external application approaches. Both approaches have advantages and disadvantages as discussed in the following sections.

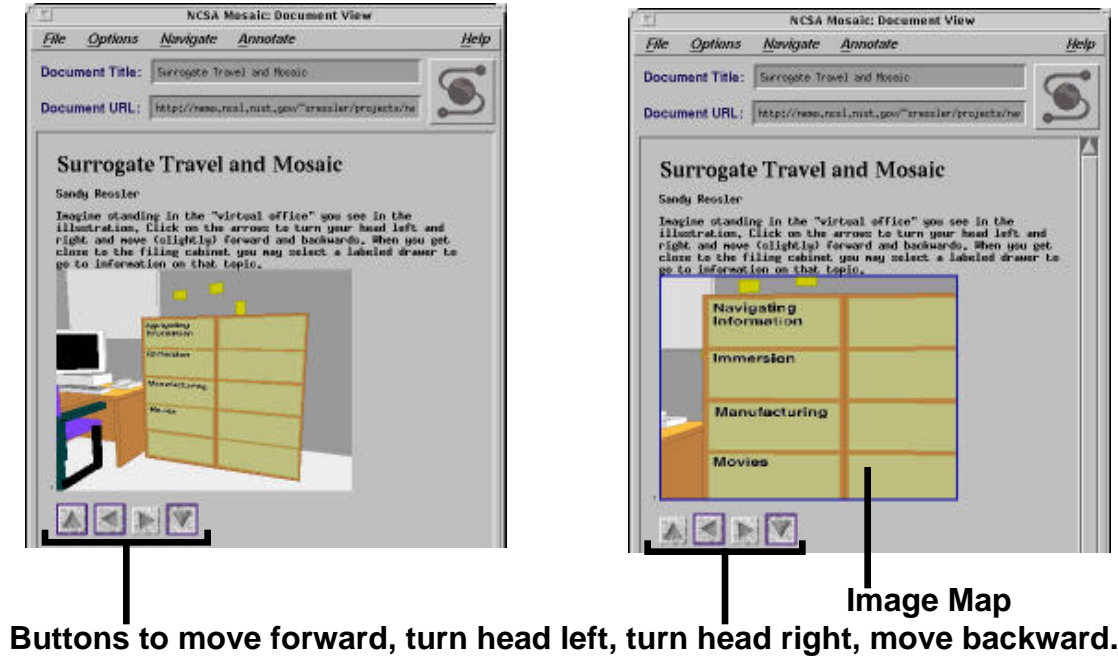
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## 2.0 In-line Graphics Surrogate Travel

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Using the in-line graphics method of surrogate travel the user is presented with a graphic that visualizes a first person point of view (POV) in the middle of a Mosaic page. In addition to the graphic the page contains buttons which allow the user to con-

control movement through the space. When a button is selected the user “moves” through the space and the graphics is updated.



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**FIGURE 1.** In-line Image Surrogate Travel and Mosaic

In the initial version of this experiment each scene was hand coded into a separate HTML page (clearly a hack). Subsequent to this a more extensive version allowing more complete travel through the room was developed by Allen Sun called the Virtual Corridor. In this version the users movement commands interact with a cgi-bin command which computes the correct image to use and automatically provides the linking. Users can get a demo of both these techniques at the URL:  
<http://nemo.ncsl.nist.gov/~sressler/projects/nav/nav.html>

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### 3.0 External Graphics Surrogate Travel

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Using this technique of surrogate travel, the user is presented with a completely separate application. This application “drives” Mosaic via remote control. The principle advantage is that the user is able to manipulate a 3D environment in real time using all of the resources and performance of the graphics workstation, independent of the network bandwidth. The disadvantage is the loose coupling of the separate application with Mosaic and the need for a separate user interface.

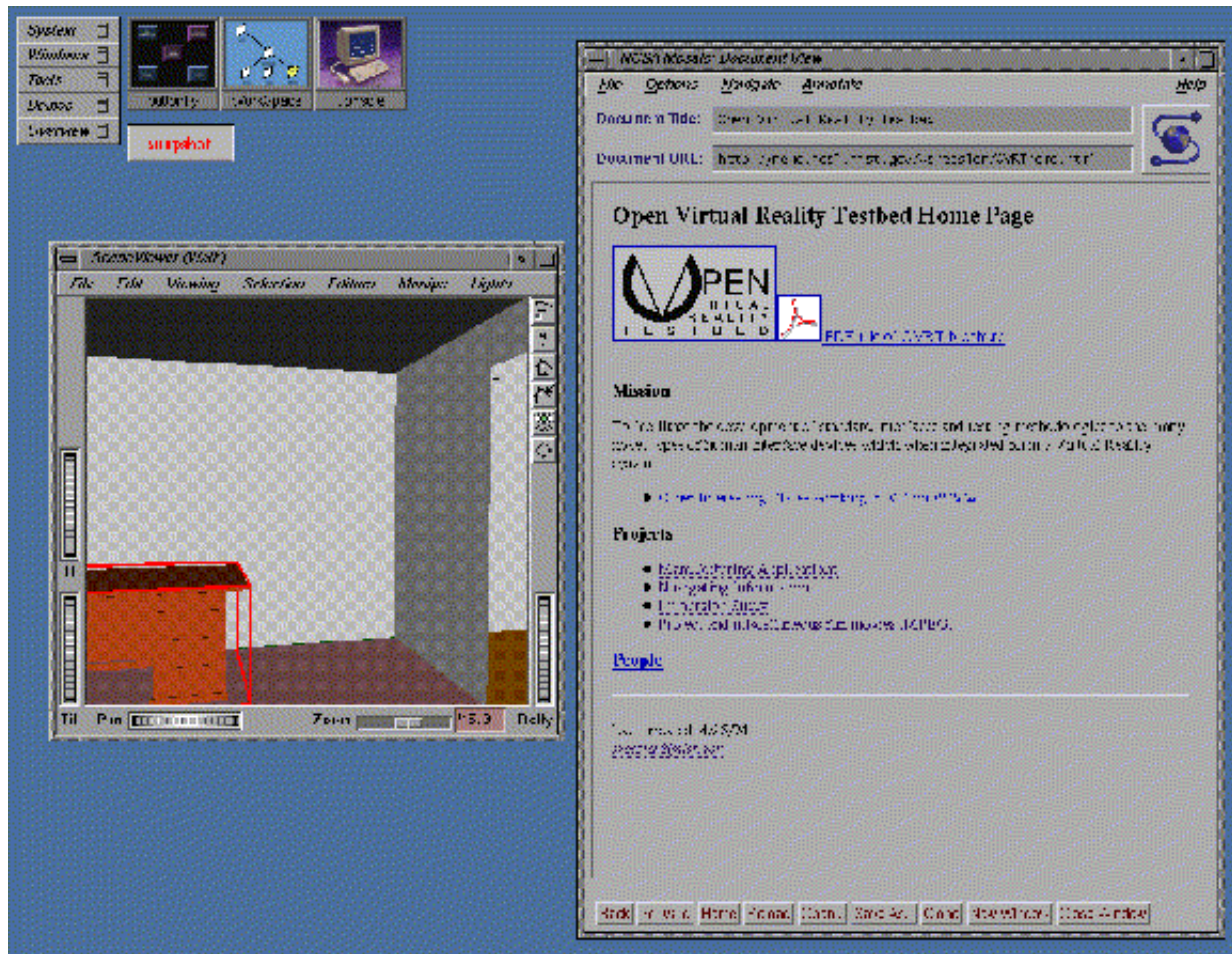
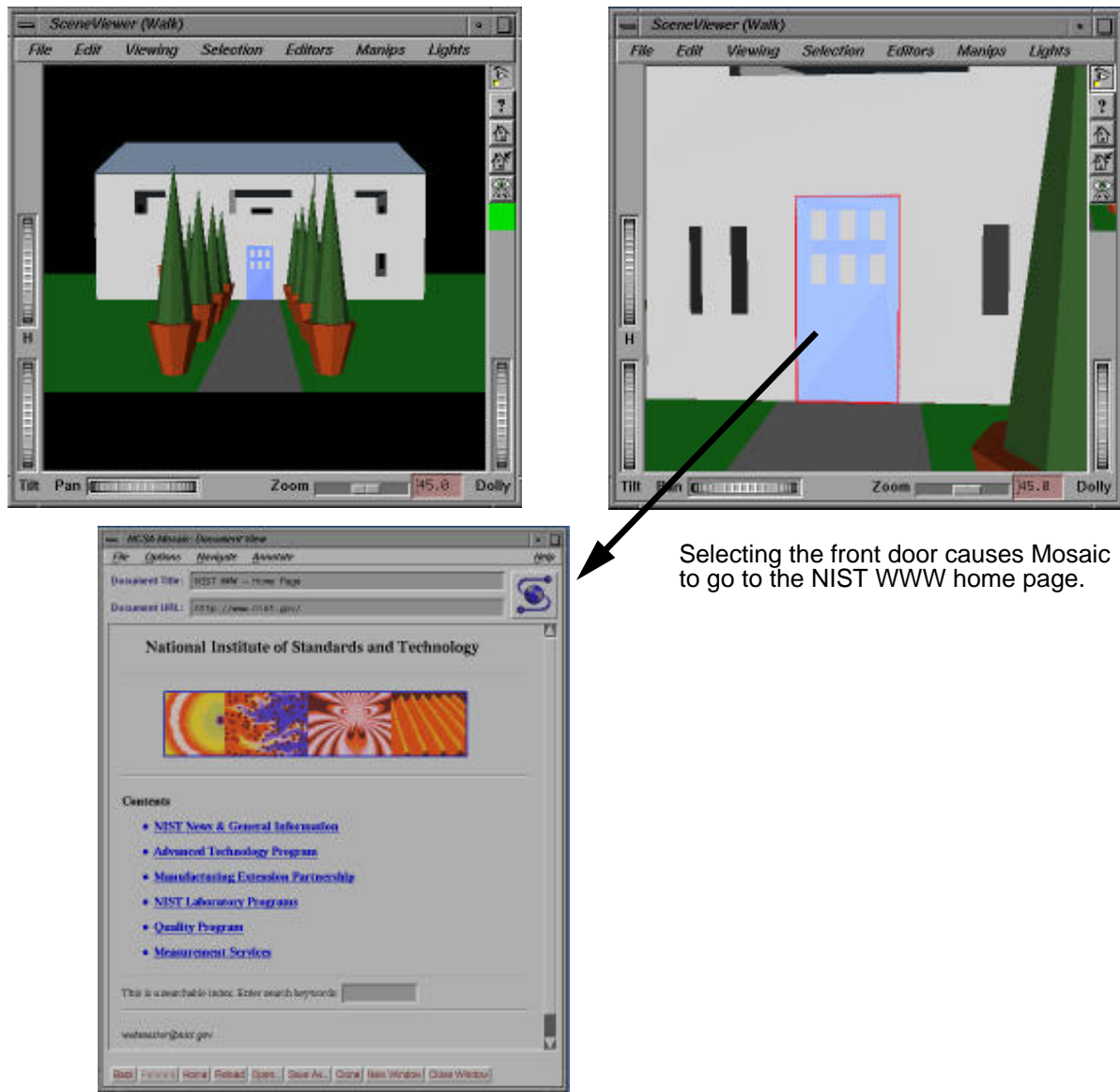


FIGURE 2. Workstation screen with URLViewer driving Mosaic



Selecting the front door causes Mosaic to go to the NIST WWW home page.

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**FIGURE 3.** External application (URLScene) controlling Mosaic

The existing test application is a modification of the SceneViewer, Inventor application provided by Silicon Graphics [Inventor]. The SceneViewer program was modified to interpret object labels which are URLs. The URL is sent to a script which generate the appropriate UNIX signal causing Mosaic to go to the URL in the label. Following is a fragment of the Inventor file for the house containing a URL:

```
Separator {  
  Label {  
    label "http://nemo.ncsl.nist.gov/~sressler/OVRThome.html"  
  }  
  ShapeHints {  
    hints (SOLID | ORDERED | CONVEX)  
    creaseAngle 0.6  
  }  
}
```

This method of control requires the ability of Mosaic to respond to a SIGNAL generated from an external process. NCSA Mosaic for the X Window System provides this feature and is documented at NCSA [Remote].

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## 4.0 Future Directions

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There are a number of directions these experiments can take. First it would be useful to extend the in-line graphic control to interact with a program that computes the views on the fly and returns a new in-line image file. This approach should also be practical for wide Mosaic distribution as the 3D computations and rendering takes place on the server. Image files could be sent back to less powerful CPUs, i.e. PCs.

In addition extensions to the external application, URLviewer, to allow use of an immersive environment should prove useful. The addition of a 3D position tracker and head mounted display (HMD) would enable the user to become immersed in the environment and therefore indirectly into the data. Current HMDs however are not of sufficient quality to allow for any significant amount of textual reading so new representations of information would need to be developed.

Finally there is also an opportunity for the generation of VR clip art that could be used in conjunction with these approaches. 3D clip art has been around for a number of years [Swivel] [NEC]. These clip art packages provide the end user with manipulable objects that can be positioned and rotated to any orientation and then included into documents. For the WWW one would like to travel to a location (i.e. a dinosaur museum) and get a 3D clip art object meaningful to the user and place that object on ones virtual bookshelf. You then attach the URL to the object and providing a 3D hotlist meaningful to the user.

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## 5.0 Acknowledgments

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Most of the actual labor to realize these experiments was due to a number of students I was fortunate to work with. Mark Pflaging a student at George Washington University working for Joe Psotka at the Army Research Laboratory (the initial VR sponsor) modified the SceneViewer application. Allen Sun a student at MIT working at NIST glued the Inventor application to Mosaic and developed the Virtual Corridor in-line graphics program. Sharon Davison a student at Catholic University and Mark Pflaging modeled the house for Sharon's dissertation.

## 6.0 References

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[Bolt] Bolt, R., Spatial Data Management, DARPA Report Architecture Machine Group, MIT Cambridge, MA 1979.

[Donelson] Donelson, W., "Spatial Management of Information", Proc. ACM SIGGRAPH 1978, Atlanta, Georgia.

[FSN] File System Navigator by Joel Tesler and Steve Strasnick, available from Silicon Graphics Inc. at [http://www.sgi.com/free/cool\\_sw\\_01.html](http://www.sgi.com/free/cool_sw_01.html)

[Herot] Herot, Carling, Friedell, Kramlich, "A Prototype Spatial Data Management System", Proc. ACM Siggraph 1980, Seattle WA.

[Inventor] IRIS Inventor Programming Guide 1992 (new version is called Open Inventor) Silicon Graphics Inc., Mountain View CA.

[Labyrinth] Labyrinth-VRML Specification by Parici and Pesce can be found at <http://www.wired.com/vrml/proposals/labspec.html>.

[Lippman] Lippman, A. "Movie-Maps: An Application of the Optical Videodisc to Computer Graphics, Proc. ACM SIGGRAPH 1980.

[Mossberg] With eWorld, Apple begins an onslaught of on-line services, Wall Street Journal, June 23, 1994.

[NEC] NEC Clip Art 3-D from NEC Technologies Inc.

[Newsbytes] Packard Bell intros new multimedia PC Navigator GUI, Newsbytes March 10, 1994.

[Quinlan] Tools put virtual reality into Apple's QuickTime by Tom Quinlan, InfoWorld June 20, 1994.

[Remote] Using Mosaic by Remote Control is at <http://www.ncsa.uiuc.edu/SDG/Software/Mosaic/Docs/remote-control.html>

[Swivel] SwivelArt a 3D clip art collection from Macromedia, San Francisco CA.

[VRML] VRML information can be found at <http://www.wired.com/vrml/>

[WebOOGL] OOGL Proposed as Geometry Format for VRML by Munzer, Chi and Burchard of the Geometry Center in Minnesota can be found at <http://www.wired.com/vrml/proposals/oogl.html>, and the WebOOGL Experiment at <http://www.geom.umn.edu/docs/weboogl/weboogl.html>

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**Author Biography**

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Mr. Ressler has been at the National Institute of Standards and Technology for the past 9 years involved with various aspects of product data standards development. Mr. Ressler has been involved with a variety of interactive computer graphics and video technologies for almost twenty years. While at AT&T Bell Laboratories he created a number of innovative computer graphics demonstrations on a real time animation system. He was involved in the prototype development of a video disk information kiosk which later became part of Disney's Epcot center. He is author of "*Perspectives on Electronic Publishing*" and co-author of "*Life with UNIX*" (both of Prentice-Hall). He is also the author of a course for a subsidiary of Addison-Wesley entitled "*Multimedia Development-A Hands-On Workshop*".

Currently he is Project Leader of the Open Virtual Reality Testbed, whose mission is to identify practical realizable applications of VR technologies, and to perform proof-of-concept demonstrations of prototype applications of VR technologies for real-world problems.

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