

Development and evaluation of the user interface of QuickTime VR image-based environment for distance learning classroom

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Abstract

The purpose of this study is to design friendly interface for users to interact successfully in a Quick-time VR Image-based environment. Imaged based Quick-time Virtual Reality software were evaluated to see what interface design principles were implemented in relation to current virtual environment. Major problems found in the evaluation were (1) ambiguous perceptual pointer design, (2) misplacement of map indicator, (3) inappropriate metaphor design and (4) inadequate movement in panoramic movies. According to the results of evaluation, the Distance Learning classroom at Tamkang University were virtualized to Quick-time VR environment for web-based tour. Development process and results of usability testing were also discussed in detail.

Introduction

Over the past decade, there have been dramatic advances in the technology used to present image-based information. The focus of this study is to design friendly interface for users to interact successfully in a Quick-time VR Image-based environment. A good interface design can make navigation simple and perception obvious, and inappropriate design will bring frustration and anxiety for

many users of VR Image-based systems. The task for interface designers is to understand the technology and be sensitive to human capacities and needs (Shneiderman, 1998). Cooper (1995) also stated that "users would rather be successful than knowledgeable". Research on user interfaces is focused on ways to make the manipulation of new interfaces a less stressful task. However, designing an object to be simple and clear takes at least twice as long as the usual way (Nelson, 1977). Therefore, the focus of this study is to design friendly interface for users to interact successfully in a Quick-time VR Image-based environment.

QTVR interface evaluation

QuickTime Virtual Reality, more commonly known as QuickTime VR, is a cross-platform technology developed by Apple Computer as an additional layer to QuickTime. QuickTime VR is Apple's award-winning photorealistic cross-platform virtual reality technology that makes it possible to explore places as if we were really there. At the intersection of commercial photography and new media technology, QuickTime VR moves the photographic image from the flat, 2D world into a more immersive experience, complete with 3D imagery and interactive components. People can use QuickTime VR (QTVR) technology to plan, explore and create

immersive imaging at their own desktop or deliver virtual web worlds. For example, a trainee marine could learn about the interior of a submarine using a VR system, so that when he or she arrived at the real submarine, they would be familiar with different compartments and their access points and how to operate relevant controls. Basic operation and interface in QuickTime VR includes:

- Looking around in panoramic movies.
- Turning object around in object movies.
- Zoom in and out.
- Moving zoomed-in objects.
- Show hot spot
- Hot spot return

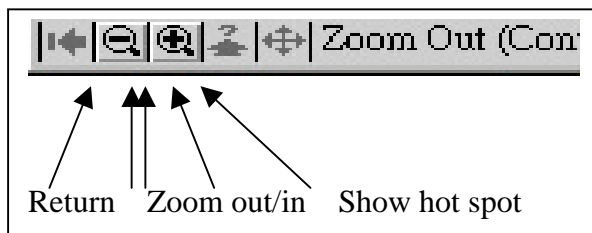


Figure 1.1 Interface panel of QuickTime VR

To explore the usability of QuickTime VR interface, two image-based Quick-time VR software were selected for evaluation. By using qualitative methods such as expert review, interview and observation, Microsoft Encarta 98 Encyclopedia and Virtual Tour of Yunlin University were examined to see what interface design elements were used and how they were implemented in relation to current virtual environment. Hot spot return, zoom in/out, show hot spot, and object moving were four basic interface tools examined in the evaluation.

Evaluation on “Microsoft Encarta” and “Virtual Tour of Yun-lin University” revealed

several usability problems of QuickTime VR environment. Major problems found in the evaluation were (1) ambiguous perceptual pointer, (2) misplace of map indicator, (3) inappropriate metaphor design and (4) inadequate movement in panoramic movies. Most novice users were not sure where they were and what they should do next. Specific interface problems were also listed below.

- Users did not know where to start and where to click.
- Users felt lost all the time, they need map, direction, instruction, or sign to show them where they are.
- Novice users were not familiar with click and drag. Although the program provided instruction such as: ”To rotate the images, hold down your mouse button and drag in any direction”, novice user still felt confusing.
- Hot spot buttons were not obvious, then obvious but disruptive. They need to be clear and distinguishable. Users did not know where the hot spots were and they argued the hot spots were too small.
- When maps were provided, there’s no “where I am” indicator.
- Most users understood and used the zoom in and zoom out button.
- Visual cues (e.g. arrow sign) in the scene were easier to identify than roll over effect of hot spot.

- Users did not notice the “Help” button.

Production

The second phase of this study was to create a Quick-time VR environment according the design guidelines from the evaluation. The information obtained from evaluation was analyzed to generate a list of guideline for the interface design. Maritime Museum and the distance learning classroom at Tamkang University were virtualized to Quick-time VR environment for web-field trip. Basics of virtual-reality technology were explored, such as planning movie, viewing and creating panoramas and object movies, and setting up hot spots. Hardware and software requirement were listed below:

- Pentium III 500 Mhz, RAM 128MB
- Windows 98 or Windows 2000
- LivePicture Viewer
- Digital camera: Kodak DC4900
- 360 Plat sturdy Tripod
- Lighting equipment
- Live Picture PhotoVista: This tool creates QuickTime VR panoramas from panoramic PICT images. It speeds up production of QuickTime VR scenes by dragging and dropping all media elements within the Scene Editor window.
- Live Picture Reality Studio: Create complete multi-node scenes containing VR panorama movies and object movies. Link other VR content, URLs, and author-defined data to hot spots

within panoramas and objects. Integrated hot spot editing and create hot-spot links directly on the content.

- Macromedia Dreamweaver
- 3D and Video: Strata Studio Pro, Ulead Media Studio
- Image Processing: Adobe PhotoShop, Adobe Illustrator

The production of Virtual Maritime Museum and Distance learning classroom lasted for eight weeks. The pictures were designed to help the visitor feel what it is like to be in the Museum, rather than to show actual exhibits. Major production steps included taking photographic or three-dimensional input for panorama and object movies, working in digital form, delivering the movie to the Web and multimedia, and other operations. The production processes were listed below:

- Photo and panoramic scene creation
 - ✓ Used wide-angle lens and took one shot every 15-degree.
 - ✓ Avoid light reflection (do not use flash).
- Imports of panoramic photographs
- Converts panoramic images from photographs taken with panoramic cameras into QuickTime VR format.
- Converts panoramic images into fully functional QuickTime VR panoramic movies.
- Image processing and composing
- Interface development and web document programming.

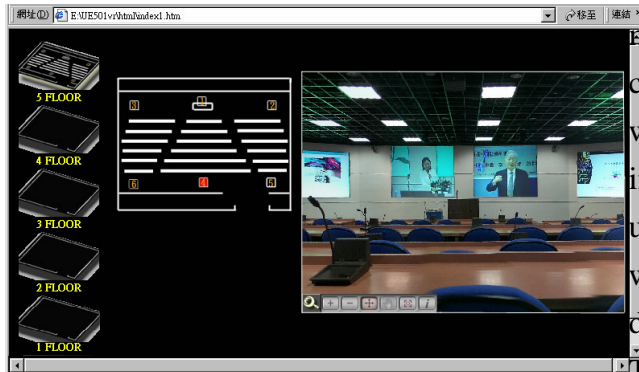


Figure 1.2 Three basic frames of Virtual Tamkang distance learning classroom

Evaluation

After the production, usability test procedure was implemented for this stage of evaluation. The phrase usability testing has been coined to represent the process of involving users to evaluate a system to ensure that it meets usability criteria (Corry, Frick, & Hansen, 1997). Dumas and Redish (1993) defined usability testing is a systematic way of observing actual users trying out a product and collecting information about the specific ways in which the product is easy or difficult for them. Usability testing was effective because real users perform real tasks under the eye of experienced observers. In order for the evaluation to be predicted accurately, it has to be evaluated with the eventual end users, performing realistic tasks, and in a realistic environment (Hewson, & Maguire, 1999). Weinschenk, Jamar and Yeo (1997) also stated that “all you need to test is ten people if they are representative of your real users, testing ten people who are truly representative will capture 95% of the problem”.

The purpose of the test was to determine how efficiently and effectively that users could navigate in the QTVR environment. The study used qualitative data collection

methods. An array of methods was used to collect information related to this evaluation, which included think aloud, observation and interview. Subjects used in this study were undergraduate students who were familiar with Microsoft Windows environment and did not used QuickTime VR interface before. The evaluation took place in four days and each day three students spent about forty minutes navigating the VR environment.

The evaluation required the users to talk aloud as they went through the VR environment, explaining what hindered and facilitated their navigation. Think aloud protocol is a specific kind of verbal protocol in which the user says out loud what she thinking while she is carrying out a task or doing some problem solving (Preece, et al, 1994). Subjects worked their way through the Imaged-based VR environment while thinking aloud. Participant observation and interview were used to collect information from the users. Two observers oversaw and recorded the process and they interviewed the subjects immediately after their navigation.

Expert review was also used to gather information from interface design experts. After the programs were created, three interface design experts were contacted for interviews. The experts interviewed in this study were instructors of “Instructional Message Design” courses. Based on years of experience in interface design of Web-based software, they evaluated two imaged-based VR programs with the evaluation guide provided.

The general interview guide for this study involved outlining a set of issues that were to be explored with each respondent before the interview took place. Users were

also encouraged to address issues not represented in the interview guide.

Interview questions focused on the ease of use, consistency, content structure, media formats, clearness of explanation and other usability problems. For the interview portion of this study, the questions were listed below.

1. How did the interface tool assist or hinder your navigation?
2. What was the necessary interface in the VR environment?
3. How well did the visual metaphor used contribute to the understanding of the VR environment structure?
4. How would you improve the interface?

Results of usability testing

The results of this study revealed that a Quick-time VR environment that is confusing to operate could interfere with the navigation process. From the observation and interview, a list of guidelines was integrated for the design of QuickTime VR interface. The results were listed below:

1. Navigation

- When clicking the forward or hot spot button, provides visual transition effect to create sense of moving.
- Provides bigger pointer for user to understand what function they are using.
- When users wanted to return to certain place, they preferred using the “go back” button of Internet Explorer rather than clicking the floor plan dot.

- Instruction on how to navigate could be presented at the beginning of the web page.
- Do not ask user to “click and drag” for they are not anticipated to do such action in the virtual environment.

2. Hot spot

- When the hot spot panel button was pressed, all hot spots in the scene should appear. The problem with the hot spot indicator on the control panel was that the user had to press on it all the time to see where the hot spot was. It could be designed when the user presses the button; all the hot spots are shown.
- When user move to specific area such as intersection of escalator or elevator, provides hot spot to indicate alternative “entrance” or exit are available.

3. Visual aids

- Provides metaphors for information objects (map, hot spot, floor, map, city map, street blocks, street, building, floor, and room).
- Provides hierarchies of metaphorical graphic objects. (Home page→City map→Street block→Building→Floor→Room→hot spot). For example: from left to right represent large to small area.
- At an intersection or a crossroads, provides visual navigation compass (magnetic needle) to point out the direction simultaneously.
- Text could be placed at the button of movie window, or pop up window

4. Map

- Provides a map that indicates “you are here”. All maps should provide highlighted color dot to indicate “where the user are”, so users won’t feel lost. Bullets (dots) on the map should correspond exactly with the user’s movement.
- 3D map is not as clear as 2D map; therefore, maps should be created in 2D.
- A floor plan contains and conveys more information than a list of rooms. A well-designed floor plan not only shows the relationship and direction of rooms but also reveals information on relative space and size.
- To prevent the user from getting disoriented provides a constant floor plan map on screen indicates which room is currently on screen.

5. Media

- Lower volume of background music that matches the visual environment was pleasing to the users.
- Provides an audio volume control button on the screen.
- There are other ways to supply information (e.g. use narration to enhance the thermal properties of a virtual object (England, 1995).

Conclusion

It is important for designers of VR systems to reduce cognitive loading as much as possible by using other sensory input besides visual; they also need to allow for users reverting back to usual behavior in

times of stress and cognitive overload (Noyes & Cook, 1999). The author suggests that designers of user interfaces should have more training or background knowledge and more evaluations should be conducted to improve the interface of Quick-time VR environment.

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