

DIGITAL CINEMATHEQUE

Designing the Virtual Environment with Issues of the Context and Atmosphere

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Abstract. The rise of virtual environments (VEs) is made possible due to the recent rapid development of the Internet and virtual reality (VR) technologies. The purpose of this study is to explore the possibilities of the virtual environment design by examining the characteristics of VE, and comparing its differences from physical environments. In the illustration of a design project “digital cinematheque”, the context and atmosphere of virtual environments are thoroughly studied, and the feasibilities and directions of developments of virtual environments are subsequently enlightened with the proposed design concepts and related issues.

1. Introduction

The virtual environment (VE), providing interactive, immersive and multi-sensory spatial experiences to the participants, is consist of massive quantities of digital data and images in which a three dimensional synthetic environment is created. By using real-time updated data in response to the participant’s motions and various interactive interfaces, it can give the participant a sense of being in the environment.

While the emergence of VEs, people have long viewed VR technologies as a tool of design repetitions, ignoring the possibilities of design we can attain from the attributes of VEs. This study is to look for traits and development limits of virtual environments, and to contemplate its spatial style and issues of the context and atmosphere, thus helpful to the nowadays digital-era designers’ creativities of architecture and spatial design.

1.1. DEFINITIONS

A virtual environment (VE) has been designed for functioning as a three-dimensional interface to a repository of images and sounds. In this paper, we use “virtual environment” instead of “virtual reality”, because VE doesn’t necessarily try to replicate reality. VE is defined as an interactive computer-generated environment that provided by a VE system, which is a human-computer interface that provides “interactive immersive multisensory 3D synthetic environments”(Stuart, 1993) by using position tracking and real-time update data in response to the user’s actions to give the user a sense of being in the environment. The terminologies used in this paper are defined for supporting further discussion.

- (1) Reality: Actually being or existing, not fictitious or imaginary.
- (2) Virtual: On contrary to “real”, virtual often means being unreal in essence, or a hypothetical particle whose existence is inferred from indirect evidence.
- (3) Context: Any surrounding or pervading influence, and the interrelated conditions in which something exists or occurs. It is sometimes rephrased to “setting”.
- (4) Atmosphere: Referring to the characteristic background of a place, including the typical environment of a given locality or period, class of people, or way of life.

1.2. PHYSICAL AND VIRTUAL WORLDS

The emergence of virtual environment changes the function of real space (Mitchell, 1995). Therefore, this study first compares and analyzes the differences between physical and virtual environments by various building types, such as museums, libraries, bookstores, banks, and department stores. The comparisons provide the direction for defining the design concept in the proposed projects. Through the analysis above, the relationship between physical and virtual environments is further classified into three types, i.e., replacement, complement, and independence. The first relationship views VEs as an identical space to PEs and can further replaced the latter, the second emphasizing on its complementary functions to PEs, while the third relationship concentrates on the independent spatial features and new experiences in VEs different from the existing ones. We have studied these relationships in a series of designs, including crystal gallery, painting studio, and digital cinematheque. The last project that develops an independent relationship between VEs and PEs is derived from the experiences from crystal gallery and painting studio with the relationship of replacement and complement respectively.

2. Characteristics of VEs

This section explores the traits and characteristics of VEs as follows.

2.1. SPACES IN VIRTUAL ENVIRONMENTS

What is space in VEs? The question addresses the spatial character of “decomposition and assembly of spaces”. In VEs, architectural space is no longer fixed due to the hyperlink technology. Buildings in VEs could be decomposed into several spaces, which appear in terms of 3D models, homepages, etc. Also, those numerous small spaces could be reassembled and integrated as a whole building. The spatial boundary is loosened and redefined by the distribution of information in VEs.

2.2. A SENSORY MULTIMEDIA ENVIRONMENT

People recognize places by perceiving the atmosphere in the appearing environment. Such specific atmosphere, sometimes so-called "sense of place", consists of settings of the circumstance of place, timing, people or life style, and is perceived by human sensation. Current VR technologies provide imitations of all possible human sensors, and thus a multimedia environment, which enables participants to perceive visual, acoustic, smell, and tactual experiences, begins to take shape.

2.3. INTERFACE DESIGN

As there are three relationships of replacement, complement, and independent between PE and VE, that means VE is able to transmit the same concepts in abstract way as well as in realistic simulation. Thus a clear understanding between users and VEs is important and can be achieved by interface design through spatial elements of "wayfinding, linkage, context, and atmosphere" (Chiu et.al., 2000). A well-designed interface of VEs can extend and enhance the user's spatial awareness, interactions with VEs, and controls over the objects and settings of VEs.

2.4. PHYSICAL FUNCTIONS AND CONSTRAINTS

There is no real site, no physical constraints such as gravity, inertia, weather, geometric boundary, etc., even no confinements of building codes and budgets in VEs. The absence of those physical constraints also indicates that the substantial functions of architectural elements have altered or disappeared. The relationship between forms and functions is left open.

2.5. PROGRAMMABLE SPACES

From “Form follows function” or “House is a living machine” to Formalism till now, relationships between form and function has been changed over the last few decades. In PEs, the correspondence between spatial forms and functions is usually a rigid one-to-one relation. The character of a space is constant, allowing no giant alteration unless the whole building is reconstructed, while VEs allow such variations. The attributes and functions of a space could be altered through different programs and spatial settings. Places are programmable (Mitchell, 1995). Users are enabled to control the quality and settings of a space. A place designed for VEs featuring the relationship of independent should be programmable, providing users with proper controls over the conditions, attributes, even looks of spaces and objects, in order to achieve better interactions with environments.

3. Demonstration - Digital Cinematheque

As the analysis above, VEs can be designed with independent characters by creating programmable spaces, which in turn can be achieved through a proper interface design with sensory multimedia environment. Spaces are featured by high user behavior autonomy, as well as the control on environment settings and information acceptance. Thus Digital Cinematheque is a virtual theater displaying different kinds of arts and performances, which is created and used as the foundation for discussion.

3.1.DESIGN CONCEPTS

The theater experience is a sort of entertainment activity. Entertainment is message, audiences digesting messages, while actors, singers, and dancers producing the messages. Theater is responsible for disseminating the messages and information. In ancient Greece, the forming of the theater is based on how Greeks viewed the relationship between the performers and audiences. Its shape shows that the acoustic and visual conditions have been seriously considered. As in the background of VEs nowadays, alterations occur between the audience, stage, and performances geographically. Though the physical conditions differ, the essence of performing space is still the same. Any type of performance is basically a demonstration of relationship between to see and to be seen. So, the essential design concept is “How does this virtual theater, Digital Cinematheque, take shape from its spatial essence?” and “How are the messages transmitted?”

In which manner, VE will become a programmable place which participants can interact with throughout design interfaces. The composition

of context and sensations of human body such as visual and acoustic factors, which perceive the atmosphere of virtual environments, are in turn discussed with the proposed design concepts and discussion of related issues.

TABLE 1. Comparison of the real and virtual theater

			Real Theater	Virtual Theater
Definition			The place to transmit entertainment message	The place to transmit and generate entertainment message
Comparison	Users	1.Control	Corresponding to the fixed seat, viewpoint, and playbill	Changeable seats, views, and display order
		2.Sociality	Theater experience stands for a kind of social function and a symbol of taste	Social function should be enhanced in other terms
	Infor- mation	1.Circulation	Directly exchangeable	One-way
		2.Time	Live	Pre-recorded
		3.Representa- tion	Real existence of performers and stage properties	Digital models and videos
	Space	1.Form	Circular or polyhedron	No fixed shape
		2.Organization	The spatial layout of “backstage-stage-auditorium” is defined by functions	Hyperlinks break up the rigid spatial relationship
	Substitution and transformation of elements			1.Theater
2.Stage				2.Screen
3.Auditorium				3.Anywhere

3.2.CONTEXT AND ATMOSPHERE

VE is featured by its multimedia environment, which is basically made up by different elements of human sensations to form what so-called atmosphere, while environmental designs essentially deal with various context factors in surrounding environments. So, it is found that the context and atmosphere of VEs are critical to the user’s spatial awareness for better understanding of environments surrounded. Therefore, this study focuses on how the context and atmosphere of VEs should be appropriately revealed.

3.2.1. Context

PEs consist of diverse interrelated objects, scenes, and conditions which together form an integral surrounding. The composition of VEs can also be classified into participant, event, time, location, and objects. As the substantial function of an object in VEs has changed from that in the real world, many physical functions of architectural spaces such as banks, malls,

and libraries could be replaced by digital data. In the virtual library, for example, while millions of books are scanned into digital data, the enormous bookshelves disappear at the same time. So if all the forms, objects, and activities in VEs could be completely digitalized and flatted to 2D appearance and pure text, under what circumstances do the concrete 3D forms have the necessity to exist? What is the proper reason for all the elements in context to survive within the virtual world?

From project “Painting Studio”, it is found that the composition of spaces is determined by visual information. Forms and spaces are shaped through the display of art works, representation of the painting process, and recreation of art, as well as different ways in which people recognize spaces and view environments. A window on the wall, providing people on the both sides with different visions and scenery, defines not only the outside and inside, but also to see and to be seen. From different points of view, under variable circumstances and settings, the scene showing within the window varies. The function of the wall is to reveal the messages behind and offer accesses to information in VEs. The organization of messages in turns of window arrangement, each deriving from the way people see and recognize things and experience the surroundings, reflects how the designer views data. “Windows for looking out” addresses the spirit of this project best and offers a foundation for programmable spaces with interactive interface design. The “window” here truly refers to a setting for interaction between the participant and artifacts.

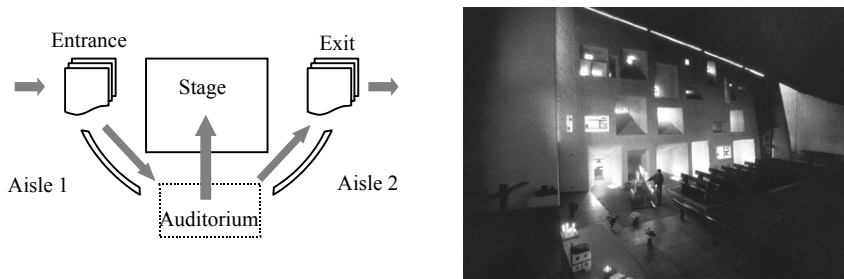


Figure 1. The layout of Digital Cinemathequ and design concept of windows

The idea of windows is applied to the visible wall in aisle spaces of Digital Cinematheque. A 3D model of wall is created instead of 2D image or text, cause the use of familiar PE forms of context in VE design is meant to offer an easier way for users to approach data and understand the environment surrounded. It is closer to user’s experience in the real world. Once the concrete wall loses its thickness and disappears, the idea is further extended to the invisible wall that separates the audience from the stage. This invisible wall is a see-through interface whose function switches with

programmable settings controlled by users. This interface provides windows for different points of view, information, background settings, and interpretations of the same performance. Users can explore the feasibilities of an unfixed context through interactions with the interface. Users become much more aware of the environments in which they are immersing, and can act on their own while experience the space and the performance.



Figure 2. Windows with different view depths.

The thickness of the wall provides a proper depth of the scene, serving as a transfer between the outside and inside. Actually, the computer screen is also a type of window, which provides opportunities to look in, and defines not only the two different worlds of physical and virtual but the to see and to be seen. Thus when browsing VEs via such screen, a familiar form of window with proper depth of view will make users feel that they are in the environment just as they are in physical world rather than watching the VEs before the computer screen. This could be made possible by the offering of acquainted forms of a 3D wall rather than plain web pages filled with text.

3.2.2. Atmosphere

People recognize their existence and places by perceiving the atmosphere of their surrounding environment. It is the information of vision, sound, smell and other human sensations that consist individual's memory of a place. Current VR technology attempts to promote a vivid simulation in those human sensations by high-resolution images, stereophonic sounds, digital scents, pressure gloves, and other biofeedback sensors. Those computer-generated experiences constitute the atmosphere and establish the distinct sense of a place in VEs.

This project focuses on the dominant senses of vision and acoustics. In performances of the Chinese poetry, exactly the same poem is shown in different terms, such as text, codes, images, music, and vocal recital included. Once the relationship of replacement, complement, and independent is set up, abstractions and metaphors take place. Objects in VEs don't necessarily exist, nor do the colors, shapes, and textures, those visual information by which we use to recognize things in PE. Individuals understand VEs by elucidating the appearing metaphors and abstractions. When designing, one should consider different individual abilities of space perception and metaphor interpretation,

providing full enough environment information to ensure user's spatial awareness. Such information can be friendly disseminating by various sensory elements of atmosphere. In the demonstration of Chinese poetry, one could understand VEs through different visual and acoustic conditions, and attain a better comprehension of artistic and poetic conceptions.

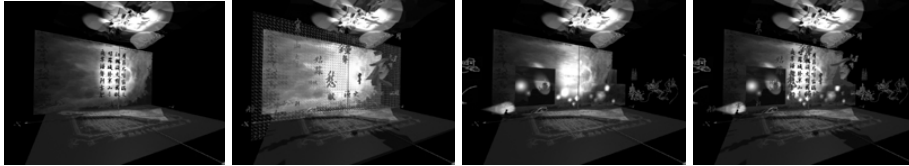


Figure 3. Different modes of atmosphere when demonstrating a poem.

3.3. DESIGN INTERFACES

Two different kinds of interface design are presented in this project: image-based and model-based VR. The first provides purely the browsing of images and the limited choices, while the second offers users a greater freedom of interaction when immersing in VEs. Different interface designs above stand for different degrees of freedom. VE is somewhat a world of control constructed by the designer. User's autonomy and dominance are controlled by the designer's intention which varies with the essence of space. Painting gallery may be well interpreted in 2D images when a close look of art works is needed, while it is undeniable that dancing should be presented in a dynamic way of exhibition rather than freezing images. In this case, the size of models and rendering technology play another crucial reasons. VRML format does not ideally present the visual elements of lighting and textures, and a serious time lag occurs in dynamic objects when manipulating.

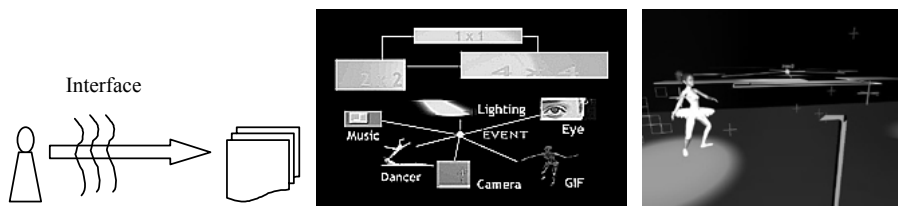


Figure 4. Interface design and its relationship between to see and to be seen.

4. Discussion

The basic concept of what designers can do with the virtual architecture is discussed above. The series of design projects show that the context and atmosphere of VEs could be achieved through visual and acoustic experiences in multimedia environments. Through interface design, users can control the context and atmosphere settings, and spaces become programmable and functional. Forms and compositions of the context are founded on the mutual relationships between forms and information in which forms must come with information. Providing the spatial experiences and settings that are familiar to the users, the designer can make the users and environments reach the best status.

4.1. BEHAVIORS OF PARTICIPANTS

The interaction between the user and the VEs can be in different modes, such as the user, agent, monitor, or immersion mode for different purposes (Chiu et.al., 2000). Such differences of participant's behavior are driven by varied psychological needs and divergence of demands in spatial awareness. When entering a programmable virtual theater, one may expect to be a computer user monitoring the screen, a traditional audience watching the show, or even the dancer performing on the stage. Further, the dancer can be the agent of user dancing according to the user's control. Different kinds of immersion bring different degrees of interaction and spatial awareness, and stand for diverse ways of how people experience environments.

4.2. ABSTRACTS AND DESIGN MATAPHORS

All seen or heard artifacts in VE are neither physical nor necessarily representations of physical ones. Objects in VEs are made up of data, of pure information covering by any possible appearances. It is a world of abstractions and metaphors (Campbell, 1996). In VEs, metaphors can be presented by various forms without physical restrictions (Chiu et.al., 2000). VE incorporates images, icons, diagram, and abstracted artifacts that depict the familiar objects and scenes in our real life. The real-world concept of objects can be replaced by text, images, models, animations, and even a button by the means of metaphor. The "window" applied in the design concept is a kind of metaphor. Different from a frame, a window can be opened and is supposed to provide views and scenes within the opening. Something out there is expected. The abstracted form depends on the appropriateness of analogy applied in metaphors to make itself clearly understood, and brings new visual experiences that are independent from those in PEs.

4.3. INFORMATION AND SPACES

Disputes over the correspondence between forms and functions drive a lot of attention not only in PEs, but also in discussions of VEs. As the VE is a place made by massive information in terms of images, animations, 3D models, sounds, and etc., what is the new relationship between forms and the essence of information it possesses? The job designer is working on is to open up a dialogue between spaces and information. The way information shown expresses designer's attitude towards the structure of data. In VEs, information is no longer the outcomes of technologies, but the soul of forms. Form is a container or projector of the information. The rationality of a form comes from the information it carries. The appearance of space should give users a hint of the information or messages it is supposed to transfer. The existence of form is only reasonable once the form matches the content of information. Once a 3D passage linking two spaces in VEs reveals the same message as a single button on web page and no spatial awareness is improved, it can be simply replaced by a click. The attributes of information are well interpreted by the process of shaping a space.

4.4. FUTURE DIRECTIONS

This research indicates a possible approach towards VE design; future directions include introducing other perception factors of atmosphere to enrich the dimension of multimedia environment and other building types such as virtual community, virtual school, and virtual office. Social interaction in VEs also needs more in-depth studies to enhance its function. Besides, VRML technology has its constraints in rendering, and its user interface requires more improvements in control and manipulation.

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