MIXED REALITY:
THE DECONSTRUCTION OF TIME/THE RESTRUCTURE OF THE FUTURE

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Abstract

The information age has led us to experience our environment in innovative ways, especially after the emergence of virtual spaces. Our senses have been triggered and our perceptions have been significantly altered through our experience of ever developing virtual spaces, comprising of spatial metaphors coded through an abstract flow of electronic signals, or physical spaces, comprising of zones adapted to activities and channels of communication providing links between zones, or a combination of both. Using the two types of spaces, an architect can more easily interact and communicate with fellow architects as well as clients. This paper intends to explicate the concept of shared mixed realities in the field of architecture based on the construction of transparent boundaries between real and virtual spaces. In order to manage their communication, participants can utilize spatial properties (i.e. containments and movement) through the use of shared space technologies which aim to create electronic environments.

Keywords

Virtual world; mixed reality; augmented architecture; cyberspaces; space flow.

Introduction

The information age affects the experience of our environment in several ways. On one hand a radically different 'placeless' accessibility to virtual worlds develops through broadband media, on other hand the material world might gain a new importance based on embodied experience. New technologies challenge our perception and experience of space and places. Virtual places have a long history though - from worlds created in paintings and texts, perspective constructions, photos and movies, and the successive development of electronic media since the 1840s. Every time the virtual dimensions have been extended through new possibilities, history has seen paradigm shifts of genuine importance (Drewe, 2001).

We are more familiar with physical than with virtual space both as users and as practitioners. Physical space is the material object of spatial planning and urbanism. It comprises, traditionally, zones adapted to activities and channels of communication providing links between zones. Virtual space, on the other

All diagrams were developed by the author unless otherwise noted

hand, is less familiar. This partly explains the frequent use of spatial metaphors to describe it: web site, information superhighway or electronic highway, teleport, virtual community or electronic neighborhood, virtual or digital cities, the city of bits, etc. These spatial metaphors need to be handled with caution as they tend to obscure issues or even turn into ideologies (Graham, 1998). Metaphors are to be avoided when the issue is how to deal with the interactions between physical and virtual space. In other words, they must be defined as distinct entities. Virtual space, the less familiar of the two is, after all, "no more than an abstract flow of electronic signals, coded as information, representation and exchange" (Graham 1998).

This review is an approach to illustrate shared mixed realities based on the construction of transparent boundaries between real and virtual spaces. Shared space technologies aim to create distributed electronic environments where participants can exploit spatial properties such as containment and movement in order to manage their communication.

Virtual Architecture: Design in the Era of Complex Communications

Architecture as a discipline of designing and organizing space is undergoing notable transformations nowadays. Undoubtedly all approaches to architecture are affected by technology used for its imagination, visualization and realization. In this regard, Martin Heidegger's doctrine of the essence of technology implies that technology is not exclusively a tool, but it rather has an ontological nature and relates to how the universe appears in the eyes of human (Heidegger, 1998).

Figure 1: Audiovisual Mixing between Human and Technology.
(Source: http://deseretnews.com/dn/view/0,1249,585036699,00.html)

The technology of virtual reality makes its mark on architecture in three arenas. First, the communication and information technology provide a medium for designers to create a new world via imagination. In fact, virtual space is considered a prelude to artificial environment, transmitting the space-related experiences from the real world to the world of virtual realities.

The second arena of the influence of the virtual reality technology on architecture is the creation of perceptional spaces in the newly developed perceptional-experimental fields, resulting in unconventional thought and imagination processes. From this point of view, virtual architecture provides a tool for realization of designs free from real world restrictions (e.g. gravity, friction, form, light, and heat) through the use of concepts and endless forms closely associated with cyberspace. This leads to the notion of trans-architecture and the appearance of architectural ideas fundamentally different from those constructible in the real world. Virtual architecture, therefore, promotes the notion that free design within cyberspace, which represents an expressionistic formalism, bases a fluid or materialless architecture. The use of formless spaces implies the ideology that the real world is far more mysterious than what is conveyed by the mere facts (Jourabchi, 2003).

Finally the third arena of interaction between architecture and technology of virtual reality is the design of cyberspace itself. The information space is on its way to replace the real space, thus, its configuration in the form of computer presentations can be considered as an alternate view of virtual reality, highly regarded for financial investments. Real-world simulations within the cyberspace accommodate more and more of real life activities everyday, necessitating the architectural formulation of this new space. A global life in virtual reality is not far from realization and very soon the conventional architectural spaces will loose their functionalities. Electronic activities such as e-businesses, e-learning, e-government and many other virtual operations pave the road towards an electronic life which requires a new architecture for designing, organizing and defining three-dimensional environments within the virtual space.

Virtual Architecture: An Approach to Visualization and Realization of Physical Architecture

Utilizing virtual reality technology as a flexible design medium enables architects to visualize their ideas in a revolutionary way to further improve and develop them prior to construction in the real world. In this respect, software plays a vital role in efficient realizations of the projects at various stages, from drawing and modeling to project management and control. As a result, the nature of architectural design and even spatial-physical status of architectural offices have experienced a significant change (Jourabchi, 2003).

Since the Renaissance, standard methods of architectural design, based on drafting and drawing, have become an essential part of architecture. Limitations of traditional methods of architectural design cause models to be used only for geometrical-formal presentations. Many more architectural qualities such as

light, shadow, materials, colors, etc, which have undeniable effects on the final quality of design, are actually being forgotten, or are involved in decision-making with minimum effect. However, the progress in design techniques, from blue prints to the virtual reality technology for visualization of architectural ideas, has provided the designers the possibility of alternating spatial and formal elements and patterns through interactive experiments to overcome the abstractions due to limitations in the visualization of ideas, and to interactively assess multifarious qualities.

In conventional design methods, models and drawings can present only a few project aspects. Thus, a large part of the design must be processed in human mind and the extent of presentable architectural information is greatly reduced. In contrast, virtual technologies transform notable volume of mental processes to external processes and facilitate decision-making. In addition, traditional models can be reused to a much lesser extent compared to new virtual models. Accordingly, alterations and improvements of the ideas in the traditional models face more difficulties, whereas virtual technologies while visualizing multiple factors mentioned only in textbooks, present testable, changeable and improvable models for content and quality evaluation of the projects at minimum cost (Jourabchi, 2003).

Virtual technology may be utilized at different stages of the project. Two-dimensional drafting and three-dimensional modeling during design as well as still frame and real-time rendering during the presentation are the most basic functions offered by virtual reality in architectural design. Other common assessments offered by this technology prior to construction in the real world include static modeling, structural load bearing computations, dynamic modeling, and study of structures' behavior against wind, waves, and earthquake. In addition, time studies and project management, project measurement and assessment, provision of status list, etc, are activities which are facilitated by using computer software.

In short, technology of virtual reality, as a form of transparent communication medium, provides the opportunity of a complete immersion of senses in another reality. Virtual technology, a simulation of reality as a collection of interactive information, creates a medium which gives the designers the capability of direct manipulation of an object, placing the designer in a virtual world equipped with all of the senses present in the real world. Therefore boundaries between reality and imagination melt away, and buildings become inhabitable in the virtual world before their construction.

Virtual Architecture: Imagination of a New Space-Time in the Era of Multimedia

If we allusively accept the Heideggerian doctrine that adequate thinking about the essence of technology not only enables thinking about art but also requires it, we can conclude that an instrument for visualization of architectural ideas is not merely a tool, but rather a method towards an openness which presents totally different aspects of the essence of the subject investigated (Giedion, 1971). Although it is impossible to imagine Brunelleschi and Alberti without perspective, Loos and Le Corbusier without film and train, and Venturi

and postmodernism without television and automobile, still the simulation technology of the 1980s and the technology of virtual reality of the 1990s can be considered a turning point in the application of the instrument and its ascendancy.

Siegfried Giedion believes that a new image of architectural space is a byproduct of optical revolution and an increasing interaction between exterior and interior spaces. He claims that the concept of motion is a new phenomenon fundamentally rooted in modern conception of space (Tanaka, 2000). Although a conception of space-time dates back at least a hundred years, it was only during the past two decades that the visualization of this dimension has broadened the horizons of human knowledge about the universe. While Giedion speaks about the phenomenon of motion as an effective force for shaping a new tradition in architecture, only fifty years later, architects and artists of the age of virtual reality have to deal with an experimental area where multiple forces alternatively and continuously cut each other.

Cyberspace is a multidimensional field of forces. For this reason, the metaphor of space and spatiality seems inadequate, because cyberspace and virtual realities which exist in it create a kind of complexity of a network, understanding of which through exclusively spatial images and pictures seems too difficult. Hence two new concepts of hyperspace and topology are employed to facilitate understanding of the inner logic of cyberspace. While it is impossible to explain the two concepts themselves completely, they help to percept the complexity of networks. They are all the more efficient as instruments to understanding artworks connected with cyberspace and virtual reality (Jourabchi, 2003).

Aesthetics of New Space-Time

The constitution of space and time in computer-based environments may be imagined as cutting, folding, bending, and stretching the procedure and current of time and continuity of Euclidean space. Such an experience can be considered as a machine-made topological experiment which leads us towards a type of emerging machine-made aesthetics. The main characteristics of machine-made creative works in cyberspace are multifarious states of intervention, operation and production which emerge in sequence. Here machine is not merely a technical set but is a collection of heterogeneous elements relating a generative imbalance to a structure.

Presence and connectedness can be identified as two main categories of computer-based art in cyberspace. By changing the vertical presentation paradigm and moving toward the horizontal paradigm of connectedness and distribution, they trigger a dreamlike state which allows a telepresence of an artwork – a great step against a classic modernist tradition at the area of cybernetic art. With this in mind, and considering such concepts as data storage, the creation of defocusing, changeable identity, and interactive forms, a dialogue between the aesthetic and social requirements of cybernetic art opens endless horizons for artistic and communicative forms. Because each happening is a unique event which is shaped through the cooperation between an artist and an audience in a certain performance, formal

strategies, which usually appear in the form of non-linear expressive happenings and driven from abovementioned concepts, are difficult to be defined. Therefore a cybernetic artwork as a continuously reproducing object, by coaxing immediate and motivating interactions via an amazing combination of people, things, events, and narrations through the audience's active cooperation, attempts at expanding our consciousness about new space-time. So, cybernetic art is first and foremost a dynamic and fluids becoming, in which an artist and an audience form, perform, and interpret, while affecting each other in a changing environment. Further on we will try to explain some of the essential aesthetical concepts of cybernetic art.

Approaches to Mixed Reality

There has been a growing interest in techniques for combining real and virtual environments to create mixed realities – spatial environments where participants can interact with physical and digital information in an integrated way (Milgram et al, 94). Mixed realities may be shared, enabling people who are distributed across multiple physical and virtual spaces to communicate with one another. A variety of approaches to creating shared mixed realities have been demonstrated, including augmented reality, augmented virtuality, tangible bits and Mixed Reality boundaries (Fleischmann et all, 1999).

Augmented reality involves overlaying and registering digital information (e.g., text and graphics) onto a real world scene in such a way that the digital information appears to be attached to physical objects, even as they move about. The physical scene might be the local environment, with the digital information being introduced via a see–through head–mounted display (HMD). Alternatively, it might be remote, being viewed on a video display that is then enhanced with digital information. Early examples of collaborative augmented reality include the Shared Space system (Billinghurst & Kato, 1999) in which users share virtual objects across a physical table top and Studiers tube (Fuhrmann, 1998), in which virtual objects are also displayed in a physical space between multiple users. Both of these systems utilize see–through head–mounted displays. Systems based on video views of remote scenes are inherently sharable as the video display is usually located in a shared physical space.

Another approach to a shared augmented environment using a physical table displaying virtual objects that can be manipulated by data glove or stylus, is the Responsive Workbench. Unlike Shared Space and Studierstube, the Responsive Workbench uses shutter glasses rather than HMDs, the table itself being a screen for stereoscopic back-projection. In contrast, augmented virtuality (Milgram et al, 1994) starts from a virtual world and then embeds representations of physical objects within it. These might take the form of textured video views, for example views of participants' faces on their avatars as in the Free-walk system (Nakanishi et al, 1996), or views of remote physical locations as in the 3–D media–space interface of (Reynard et al, 1998). The projection of live video data of participants in a shared virtual environment into a virtual space was also used in the ACTS project DVP. Several CAVETM and Responsive Work-bench TM systems were linked via a transatlantic ATM

connection in a shared virtual prototyping environment (Kindratenko et al, 1998).

An alternative approach to embedding video views is to construct graphical, textual and aural representation of telemetry data that has been captured by remote physical sensors. The approach of tangible bits (Ishii et al, 1997) involves the use of graspable physical objects called phicons to interact with digital information, for example moving physical models across a table top in order to access a digital map that is projected onto it. This may be coupled with the use of ambient display media such as sound, light and airflow to provide more peripheral awareness of background information, for example, by showing the volume of network traffic as reflections of water ripples on the ceiling. A similar approach was presented earlier (Strauss et al, 1999) in the Cyber-city system, where one could navigate through a wall projection of a 3D city model by moving a "virtual finger" through the streets of a map projected on a table.

The approach of Mixed Reality boundaries involves joining distinct virtual and physical spaces by creating a transparent boundary between them (Benford et al, 1996). With this approach, the spaces are not overlaid. Instead they are distinct but adjacent. The occupants of the shared physical space can see into the next–door virtual space and can communicate with its occupants (e.g. avatars within a collaborative virtual environment). In turn, the occupants of the virtual space can see back into the physical space. A distinguishing feature of this approach is that it places equal weight on physical and virtual environments, considering how each can be accessed from the other. It also offers the potential to use multiple Mixed Reality boundaries to bring together many physical and virtual spaces into a larger Mixed Reality environment in the same way that everyday boundaries such as doors, walls and windows are used to structure physical buildings.

A related, yet differently oriented system is the Communication Wall (Breiteneder et all, 1996) where two (spatially separated) halves of a room are joined by augmented reality and Virtual Studio techniques. Participants in a shared session can communicate like sitting face-to face at different sides of a table, while the remote part is projected on a wall-size display, giving the illusion of a continuing room, respectively.

Mixed Reality may also be applied (or defined) as an extension to video conferencing systems through CSCW (Computer Supported Co-operative Work) and HCI (Human Computer Interaction) techniques (Pekkola et al, 1997). According to the specific requirements and technical facilities of a particular teleconferencing scenario, a variety of communication channels may be integrated, ranging from real face-to-face communication over VR to Internet contacts and multimedia components. Similarly, one may approach Mixed Reality concepts with respect to application context, e.g. in collaborative interior design (Kliner et al, 1997), where the concept of augmented reality is understood primarily as a paradigm for user interaction and information visualization.

Freeing the user from being tied to a stationary system is yet another way of understanding

Mixed Reality With "Wearable Computing" Systems, one becomes mobile, remaining free to move and act in a real environment while staying informed via a wearable display system that stimulates one or both eyes (Mann, 1998). There is a system developed by Sony (Rekimoto et al, 1997) that combines wearable as well as stationary computers to interactively create and store/retrieve virtual annotations to real objects.

Following Milgram's approach to define taxonomy of Mixed Reality (MR) visual displays (Milgram & Kishino, 1994), there are six different classes of MR interfaces, ordered by increasing virtual component influence (Fleischmann et all, 1999):

1. non-immersive, monitor-based video displays with overlaid virtual image components
2. immersive HMD-based video displays
3. see-through HMD video displays
4. virtual see-through HMDs via integrated video camera
5. primarily virtual display environments with overlaid video "reality"
6. completely virtual projection-based environments immersing user and surrounding reality as a whole.

Besides the ordering scheme used above, other means of distinction have been suggested, such as direct/indirect viewing of real/virtual objects (where "real" means "directly related to some physical existence" opposed to "virtual" as based on a computer generated model), producing real/virtual images (i.e. images that do/do not occlude other images further down the viewing axis, respectively). Including the world of Virtual Studios (VS), which can also be regarded as a type of Mixed Reality, another, two-dimensional, classification could be made, based on the degree of immersion (or better: impression of reality) for (a) the person acting in the virtual environment and (b) an external spectator.

Using this classification scheme, digital video post-production and virtual TV-Studio production can easily be integrated with Milgram's Mixed Reality classes, placing postproduction in one corner (least actor immersion, maximum spectator reality; changing but rather minimal virtual part), and completely immersive VR systems (using nontransparent HMDs) in the opposite one.

Common to all different approaches to the term "Mixed Reality" are two points (Fleischmann et al, 1999):

1. The existence of a combined pair of a real and a virtual space (Comris, 1998)
2. Employing the visual as the dominant mode of perception and integration of real and virtual space.

All the different approaches described in the section basically differ in the ratio between those two spaces, and the type of interface between them. While these investigations do research into complex problems such as 3D data retrieval, geometric data of layering provided by complicated tracking systems, special problems of video techniques, etc, there is less work on networking issues. In the meantime much work has been done in this field, e.g. the development of VRML and interaction synchronization and behavior

models in distributed virtual environments. At the technical level, contemporary research in Mixed Reality technologies for the broad public must focus on extending the open questions related to the VRML concept, especially in terms of multi-user communication and extension of computer graphic features provided by Java.

A Review of Shared Space Technologies

Current approaches to technologies which enable simultaneous presence of multiple geographically distant participants in a shared space can be classified into five categories (Fleischmann et all, 1999):

1. Media spaces,
2. Spatial video conferencing,
3. Collaborative virtual environments,
4. Tele-presence systems,
5. Collaborative augmented environments.

The notion of media spaces is used to refer to the "enhancement of existing workspaces with integrated audio and video communication". This differs from multimedia conferencing systems in supporting social browsing, peripheral awareness and the establishment and maintenance of long-term working relationships between physically separated people.

The term "spatial video conferencing" refers to video conferencing systems that attempt to introduce support for determining gaze direction. That means providing a way for participants to distinguish at whom one is gazing, which is normally indistinguishable when several people are presented with the image of someone looking at the camera. The key concept of collaborative virtual environments (CVEs) is summarized as that of computer generated spaces in which each participant has his graphical representation and can control his own viewpoint and interact with other participants or various representations of data. Such spaces are usually referred to as shared virtual worlds.

Typically nominated fields of applications are training, co-operative visualization, simulation, design and entertainment. The concept of telepresence is understood as "allowing remote users to experience a remote physical space through computer and communications technologies". Experiencing the space is understood as the ability to view the space, to navigate the space and to interact with objects in the space. A scenario where the remote participant controls a robot which in turn explores the physical space is nominated as a typical application.

The notion of augmented reality is understood as overlaying the views of a real world scene and the virtual scene with some level of dynamic linking between them. Besides using see through head-mounted displays or overlaying graphics onto conventional video screens, some approaches explore the use of ambient display media such as sound, light and airflow for peripheral awareness (Ishii et al, 1997). The latter is claimed to aim at providing "natural integration of digital and physical information and providing rich and multi-sensory experiences for users"(Figure 2).

Figure 2: Mixed Reality Environments: Virtual Presence in Physical space and Vise Versa.
(Source: VR Media Lab, Aalborg University, Denmark)

Relating the notion of interactive environments to the above classification places it across several categories: it involves and examines the concepts of media space, telepresence and collaborative environments. In terms of the classification, interactive environments are media spaces which may provide elements of telepresence for multiple participants in a shared space. A major difference is that the notion of telepresence is concerned foremost with allowing remote participants to experience each other - not a remote physical space.

Regarding media spaces, the approach of interactive environments is not constrained to a particular scenario and is actually more interested in exploring public space than workspace contexts. It also departs with a much relaxed understanding of "communication", and doesn't necessarily assume geographically separate participants.

The term media space is understood as enhancement of physical space with different, most often computer-based, audio-visual media but also the "spaces" created through communication between participants using different computer-based media. As to the idea of "shared virtual worlds", the notion of the interactive environment emphasizes the idea of a shared world as a world of shared experiences through interaction of participants with each other, mediated by the situation that is created by the environment. Rather than interacting with objects in a computer-generated world, the focus is on different forms

of interaction between participants or between a participant and his "inner self". The latter refers to the recognition that the responses or actions that the situation provokes us to are motivated or determined by who we are as human beings and persons that cannot be parameterized and described as yet another "object" of the system.

The Mixed Reality Stage: The Basic Concept: A Room Filled With Data

The basic concept of the Mixed Reality stage (Fleischmann et al, 1999) is that of a room filled with data. The "room" stands for physical interaction space but the furniture of data is virtual and stands for an information space. It is a spatially organized information space in which data is revealed through users' movement in the combined real-virtual space, and through interaction with other users (Figure 3.). The physical space is filled with virtual space and extended with virtual space.

Levels of Linking the Real and the Virtual

The concept of the Mixed Reality stage (Fleischmann et al, 1999) considers connecting the real and the virtual at three complementary levels:

1. linking audio-visual manifestations of physical and virtual space,
2. linking physical and virtual space through movement and bodily awareness of space,
3. linking internal construction of individual experience with externalization of experiences of others.

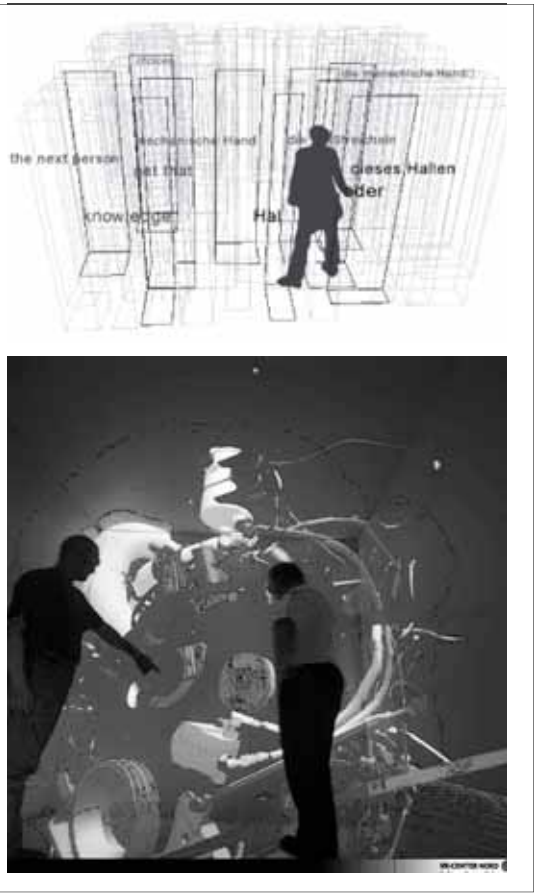

Figure 3: A Room Filled with Data
(Source: http://www.vrmedialab.dk/pr/img/galleri/cave/index.htm)

Movement reveals data from virtual space as if it were in the physical space In this concept, the virtual space is realized as an interactive field of sounds which are triggered by users' movement and emitted into the physical space. As it is the movement in physical space that causes the sounds, and as the sounds are heard in the physical space, the resulting impression for the users is that of an invisible field of sounds existing in the physical space and revealed through their actions. If sounds are understood as data of an information space, this illustrates the realization of the basic idea of using virtual data for filling real, physical space.

This is different from the approaches of augmented reality and augmented virtuality because they operate strictly in the image plane - overlaying images of real and virtual space on a video display. It is also different from the mixed-reality boundary approach where the real and the virtual space are not layered, but distinct and adjacent. Linking real and virtual space through movement builds on the recognition that movement is an essential means of perception of physical space. Hence, in order to make the perception of virtual space function at the same level as that of the real space, we make movement the basic condition for perceivable manifestations of virtual space. This is why audio-visual elements of the virtual space are invoked only through user's movement in physical space.

The presence of users in the physical space is effected through their bodies, and the movement of bodies describes the spatiality of physical space. Each individual user perceives this in a twofold manner: 1) as a bodily awareness of one's own movement in space, 2) through visual and bodily awareness of the movement of other users' bodies.

Connecting this level of real space perception with users' perception of virtual space is the reason why we annotate users' movement in real space with an audio-visual trace of movement in the virtual space. The resulting manifestations of virtual space, the audio-visual traces of users' movement, and the movement of their physical bodies, provide an externalization of the users' experience of the shared situation. The mental processes of individual users, such as interpretation, construction and imagination, are externalized and connected to their perception of the jointly constructed reality. As a result, the nature of the created situation transcends that of a "space" understood in strictly physical terms of the word. What is produced is a new reality of perception as a framework for the communication of different, individual realities of the "same" situation – a situation of mixed realities.

Conclusion

Can developed virtual environments offer hope in supporting new arenas for public discourse in cities, which are more inclusionary, equitable, and interactive than the 'consumer-model 'information superhighways, dominated by global, commodifying corporations, which seem likely to dominate virtual space in the future? Can such initiatives help overcome the economic, geographical, social and cultural fragmentation so characteristic of contemporary cities, by tying together the urban fragments together? Does the 'urban planning' of electronic spaces offer a new arena within which progressive, imaginative urban futures might be shaped? Is the city "to be replaced with a virtual urbanity, a city of the mind, enabled by telematics?" providing "channels" through which knowledge and information can be democratized, dispersed around the diversity of relational webs in urban regions" (Heath & Luff, 1991).

By using architectural methodologies to create a process where each of the required components (audiovisual, supercomputing, networking, broadcasting, virtual reality, and systems support) is synthesized, complete unified design of an efficient, working, virtual environment can be created. A lead architect

can meet individually with all these disparate groups and incorporate their needs into a master plan for building the ideal space. It is the inherent nature of the architectural profession to analyze and perform such functions. The architectural profession will also be able to guide the design plan through the rigors of build out and construction phases. However, developing spaces for virtual environments is very new. Architects will need to learn how to communicate with people from very different cultures and need to be able to reach out for help in this area when needed. Architects will also need to think in terms of traffic flow and how groups of people interact with these environments so the lessons learned from the entertainment industry should also be incorporated into this design process.

The components for creating a dynamic space for enabling virtual environments lay all around us. It requires an open minded architect to bridge the many disciplines and create a plan which can efficiently incorporate all the needs and functions demanded by such an environment. Virtual environments demand the synthesis of multiple professions into a single real space. By using an architectural methodology as a binding mechanism, a comprehensive design can be developed and the end goal of creating presence can be achieved.

The unprecedented dynamic of contemporary technological (r)evolution has created a completely new comprehension of space-time relations, communication and symbolical perception. Through global networks and their nodes, redefined symbolism influences our everyday life and its main purpose becomes transmission of proclaimed global values. Being an important resource for the global competition and recognition, urban space develops, recreates and regenerates its numerous fragments that should represent a spectacular testimony to its global initiation (real or projected), urban identity (cultural, ethnical, historical, national) and excitation or inhibition of its citizens and visitors. At the same time, technological and informational infrastructure becomes a fundamentum of the globalization process that radiates a complex message of the majestic present and promising future of a city that should be reached somewhere at the global horizon.

However, the final result of this process is not easy to predict - the future shaped by globalizing contradictions will remain an enigma whose clue lies well hidden inside the evolution labyrinth. Therefore, the basic problem of our epoch is a choice of the right direction on our way to the global challenge. The only question is - are we capable to begin this search?

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