Designing Tele Reality Using Media and Communication Technologies

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Abstract. *In this paper we describe the use of media and communication technologies with a special notification on video systems for the design of a technological enhanced environment. We make suggestions how architects can design environments that are more flexible and dynamic. These environments are adapted to our changing social and cultural trends. Developments in media and communication technologies allow extending the real world to a so called Tele Reality. These environments will have a certain degree of intelligence provided via computer performance. Humans will be able to receive information form anywhere and at anytime. The focus is on expanding the availability of human resources.*

Keywords. *Media and Communication Technologies; Tele Reality; Video Systems, Design Principles*

Introduction

The advent of media and commutation technologies has already caused a significant shift in the praxis and education of architecture. Today, our environment, created by architects and modified by its users, is more about the use of information, its generation, and exchange. The significant and extensive innovations of communication networks influence the design of contemporary buildings and allow architects creating new forms of reality. While focusing on further improvements of novel technologies itself, there is a lack in transferring them into useful and inspiring applications. Architecture certainly is one the highly interesting application areas since these technologies provide several opportunities to streamlining and simplifying everyday life. Architects are challenged, more than ever, designing technology experiences instead of designing an experience enabled by technology.

One of the great triumphs of urban planning was the separation of noisy, polluted industrial zones from leafy, garden suburban. Earlier telegraph and telephone networks, later the linkage by computer transportation networks enabled spatial separation of management from industrial production. The business workplaces of the 20th century are characterized by high-rise offices made out of steel, concrete, glass, and electrically powered systems providing the means. At the end of the 20th century architecture began to change fundamentally. The solvent of digital information was decomposing traditional building types and familiar forms vanished (Mitchell 97). According to William

Mitchell the occasions for a characteristic new architecture of the 21st century are the intersection of electronic information flows, mobile bodies, and physical places. Invisible, tangible, electromagnetically encoded information establishes new types of relationships among physical events occurring in physical places (Mitchell 2003).

Media Theory

In our work we focus on video as a novel media for designing environments that provide and require novel forms of augmentation, communication between humans, and interacting with information equipments. In doing so we analyzed the influence of recent developments in media and communication technologies on the field of architecture (Lang 2005). We are not only looking at media from a technical point of view, we also have a closer look into media theory. This is important for understanding and exploring the potential of new media.

Looking back at time, two major observations can be stated: First, new media do not replace old media, but rather complement one another. Second, most of media innovations have been developed for other purposes than they are used today in the first place. New media eventually develop their own forms, processes, and contents. The early stages of any media or technology are characterized by the imitation of earlier uses. The new technology needs to have some time before people start to see that it is not like the previous media at all, and offers other possibilities. In a first step, new media seek to solve old and already known problems in a more sophisticated way. Later on, these already familiar problems are substituted with new opportunities using the new media. This process corresponds with Marshall McLuhan's declaration that each media is an extension of who and what we are (McLuhan 1994).

For example, the written language did not replace speech. The invention of the film camera did not replace theater, and television did not replace cinema. Media are complementary. The qualities and advantages of the respectively new medium are going to be of use and therefore, complementary and new qualities are created. Sticking at the example of the invention of the camera: Searching for application fields for the camera, people started recording stage plays, from the spectators' point of view. After recognizing that this is kind of boring, the idea came up to put the camera on a trolley and zoom creating new perspectives. Unlike recording plays the new films were dynamic. The first television broadcasts, as another example, were radio programs with pictures.

However, media extend themselves beyond the original problems that gave them rise. Therefore, analyzing media development, four interesting and important questions arise:

What was the purpose of the development of the systems?

What is the use of these systems today?

What kinds of forecasts have been made?

What did really happen?

Tele Reality

Our primary interests in using media and communication technologies, especially video systems, are motion scenes. The characteristics of motion scenes are that spatial constitutions change over time. In classifying visual perception by space and time (see Figure1) and in classifying the partnership relations between persons and objects (see Figure2) it is figured out that the obvious next step for architects will be the design and development of Tele Reality. Classic Reality scenes are actual existing environments that are time and location depended. As opposed Virtual Reality (VR) consist of computer generated, synthetic scenes that are time and location independent. Unlike VR that reproduces the real world, Augmented Reality (AR) is an emerging technology where the environment includes both VR elements and real-world

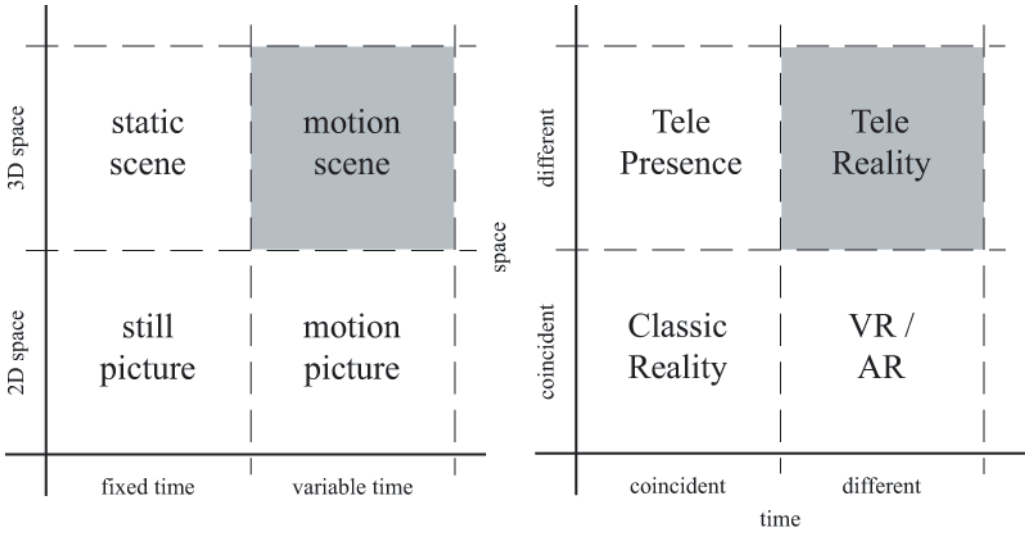


Figure1: Classification of visual perception.

Figure2: Partnership relations between persons and objects.

elements. AR combines real persons, objects, and environments with virtual complements. The term Tele Presence was coined by Marvin Minsky in 1980 in reference to teleoperation systems for remote manipulation of physical objects (Minsky 1980). Within Tele Presence systems persons and objects interact at the same time whereas parts of them are physically apart. The objective of these systems is to give users the feeling that they share the same space.

Communication tools already loose place-to-place connections. They influence our architectural understanding of geographical spaces, urban forms, and immediate habitats. For this reason, they are also of prime importance for architects overcoming space and time distances since life is getting more dynamic, flexible, and mobile. By selectively loosing place-to-place requirements media and communication technologies fundamentally alter, fragment, and recombine familiar building types, urban patterns, and space use. Tele Reality enhances the architectural spaces and reduces space and time interdependencies among persons and their activities, and enables radically different spatial implications. Therefore, also place-to-time relations are reversed and recombined. The long term goal of Tele Reality is to enable the remote and nevertheless effective participation of geographical separated participants to community life. Distant cooperation plays a more active role so that new forms of participation emerge.

In the following, the different subdivisions of these co-ordinates are described in more detail:

Space Co-ordinate

coincident space: Persons and objects are at the same location, for instance in

a shop, an office, or a private home.

different space: Persons and objects are at different locations, for instance,

shops, offices, or private homes are in different buildings, cities, or even countries.

Time Co-ordinate

coincident time: Presence or model of persons and objects happen at the same

time.

different time: Presence or model of persons

and objects may happen at the
same time as well as at different times. A scene, for instance, contains not
only real-time persons and objects, but also respectively models of them which
were recorded in the past.

Tele-presence, communication, integration, adaptivity, personalization, comfort, security, and augmentation are essential for the realization of Tele Reality in architecture. The challenge for architects, in doing so, are the concerns of privacy, translate digital information into visual and auditory interfaces, and the development of natural and multimodal interaction techniques.

Application Attributes

We found out that the most profound attributes regarding video systems for designing novel applications are camera, display, environment, immersion and capabilities (see Figure3). In the following, each of them is described in more detail. Of course, in the background there are additional components such as computers, networks, software and so on.

	cameras						display			environment		immersion		capabilities		
	no camera	real camera recorded	real camera real-time	virtual camera recorded	virtual camera real-time		no	secure	presentation	public	real	synthetic	no	yes	interaction	communication	augmentation
movie maps		X							X		X		X		X		
classical cave applications					X				X			X		X	X		
image annimation		X							X		X		X			X	
vr and robotics				X					X		X		X		X		
controlled spaces			X							X	X		X				X
interactive theater			X						X		X			X	X		
media facades	X									X		X	X			X	
architectonic represenation	X								X			X	X				X
animation				X					X			X	X				
video games					X				X			X	X		X		
digital effects				X					X		X		X				X
video surveillance			X					X			X		X				
observing surveillance project			X				X				X		X			X	

Figure3: Application attributes.

Cameras

This attribute classifies the applications by the signal dimension of the use of cameras plus whether the video footage is recorded or real-time streamed. The use of a virtual camera is also taken into account. It is also distinguished between recorded and real-time. The recorded virtual camera allows the user to freely navigate within the application instead of following a predefined camera path. The real-time virtual camera refers to the ability to interpolate in real-time between two video cameras:

no: within the application no cameras are used

recorded: within the application recorded camera images are used

real-time: within the application real-time camera images are used

recorded virtual camera: the application consists of a virtual camera

real-time virtual camera: the application consists of a real-time virtual camera

Display

This attribute indicates how the applications are presented. There are four major categories:

no: the application is not displayed

secure: only authorized users are allowed to view the application, e.g. security staff

presentation: the application is open to everyone, but the user has actively to

show an interest in viewing the application, e.g. buying the application

public: the application is displayed to the public without being asked, similar to advertisement

Environment

The environments in the different applications are created using different kinds of media. Realism describes whether an environment has a synthetic or a real representation within the application. There are two major approaches: synthetic and real.

Synthetic refers to computer generated environments.

Another approach is to capture the real existing world. This is called real.

Immersion

Immersion refers to how a system can make users feel like they are experiencing an alternate reality and not just merely observing it. The degree of immersion depends on how good the system supports the user in feeling being part of the application and not only observing it. Immersion can be achieved either through stereoscopic depth or by overlaying the real world. Yes means immersion exists, no means it does not.

Capabilities

For applications, this attribute describes the primary capabilities the systems provide to the user. These three capabilities are the most relevant within this work:

interaction: describes the possibility for the user to directly interact with the system

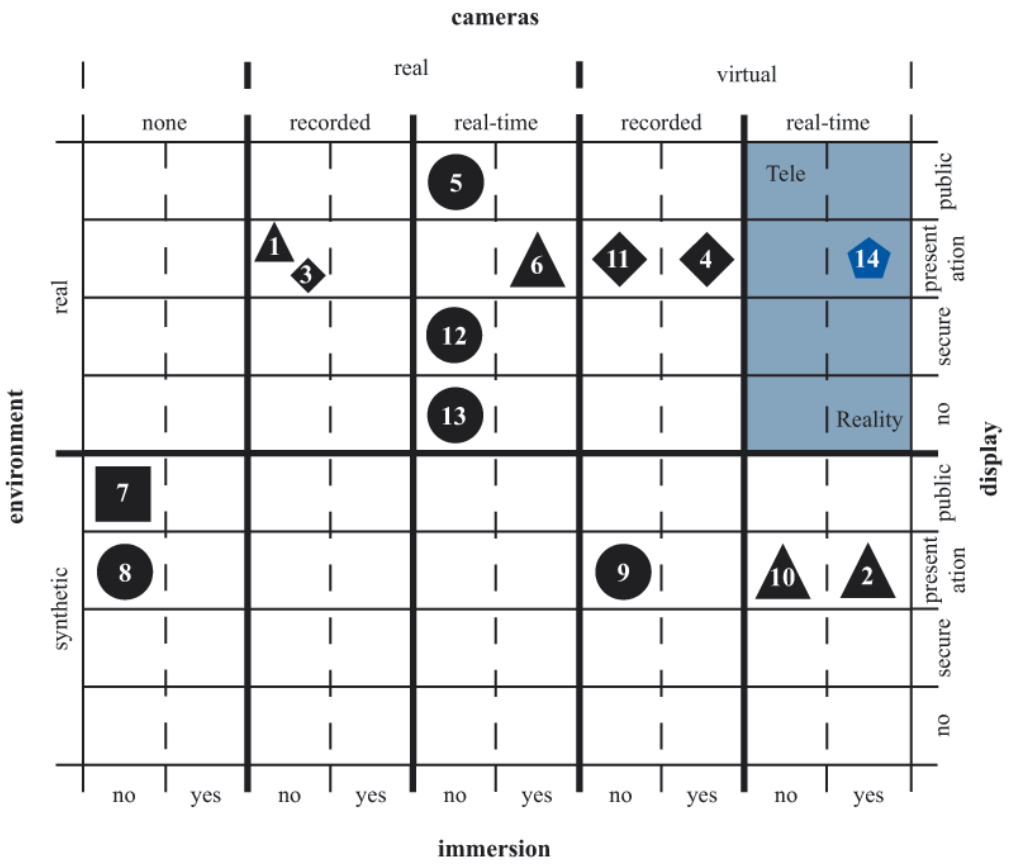
communication: describes whether the application is meant for displaying information to the user or even more let him communicate to other users

augmentation: describes the superimposition with other applications or reality

Design Space

Towards the design and development of Tele Reality we introduce a design space for the first time (see Figure4). The design space approach is similar to that used in Human Computer Interaction (HCI) since the 1980's (Nigay 1993). As proposed in Section Application Attributes the five attributes camera, display, immersion, realism, and capability describe the application space. On the basis of the breadth of systems applications are pinpointed and marked as areas for further investigations.

The fundamental objectives are to address real



capabilities/intervention

- interaction
- communication
- augmentation
- none of these three
- all of these three

applications categories

(1)	movie maps	(8)	architectonic representations
(2)	classical cave applications	(9)	animation
(3)	image animation (siemens)	(10)	video games
(4)	vr and robotics	(11)	digital effects
(5)	controlled spaces	(12)	video surveillance
(6)	interactive theater	(13)	observing surveillance project
(7)	media facades	(14)	IN:SHOP

Figure4: Design Space.

problems, to offer technical, economic, and sustainable feasibility, and to guarantee adequate usability by people. A main contribution for architects will be applying current shifts in the development of information technology and experiences in interactivity. They are asked to design spaces including computational systems where people can interact in an intuitive way. The goal thereby is creating highly interactive and visual experiences using the latest information technologies amalgamating with architecture. It is important that the technologies and their system's complexity remain invisible and hidden to the user.

Design Principles

On the basis of the implementation of prototype applications we define design principles. The focus is on attractive application areas based on the integration of technologies by taking a consumer point of view. Implemented applications are for example FashionShow (Lang 2005), Flashlight (Lang 2004), and Mirror:3D (Lang 2004). FashionShow is the development of a virtual architecture with the goal to create a space that is explorable and intuitive. Flashlight and Mirror:3D present different interaction techniques, communication between physical distant users, and the interaction with oneself. In the following we describe criteria for creating embedded, interactive, and dynamic spaces that contribute towards a Tele Reality. The motivation for designing and implementing real-world application scenarios is to bring media technologies into the physical architectural environment. This emphasizes the importance of bringing the technology closer to the user. The goal of these applications is to support what is traditionally considered as non-computational activity among humans. This includes the investigation to design experiences for end-users based on the possibilities of emerging and enabling technologies. There is an influence of technology on design. Today, technology changes very fast and issues of usability and accessibility accelerate this process. In the following, some design principles for designing environmental experiences enabled by technology are proposed.

The first step for an application developer is to identify appropriate scenarios where the novel technology can be used in an innovative way. The major factors that determine the choice of applications and the development of scenarios are the interaction possibilities for the end-user, content enhancement, and usage. Application development starts from the user point of view. Therefore, it is important to observe people, how they use technology, and do things. It is important to take behavioral concepts into account.

Tim Brown cites two classes of experience design, "top down" and "bottom up" (Brown 2004). Normally, designers use the top down method and conceive the whole design. Everything is controlled and scripted by the designer. Examples of this method are practiced by the companies iTunes, Disney World, and Prada's New York Store. But in most situations the designer is not able to control all aspects. Whereas the bottom up method emerges and evolves out the actions of the users. The companies eBay, NTT (Nippon Telegraph and Telephone Corporation), and DoCoMo are engineered using the bottom up experience.

The first goal of designing applications using novel technologies is to get people to understand what possibilities this technology can provide and to figure out a way how it can be integrated into their lives. In order to get user interested interactivity and the ease of use are at the heart of these applications. The concept of interactivity has to be analyzed and decomposed from the perspective of the end-user, content, and application. The number of options and choices for the user have to be kept at such a level that they can handle them. Different kinds of levels include: personalization (setting profile), composing own viewing experience (navigation), and influencing scene composition (participation). To keep the user attracted and

to motivate him to use the application more than once it is important to create a non-linear experience and let the user influence the story line. This can be achieved by introducing a virtual camera. This allows the user to skip parts, to choose from available scenes, to make changes in the scene composition, and to go back in time storage. This is very important for the design of interesting and attractive applications for users. Therefore, it is commendable to enhance the applications with on demand data, personalized content, and fictional content.

Good application design requires joints between different disciplines. At this point in time architects and technology engineers must work together from the very beginning of the process to form an interdisciplinary team.

In order to illustrate the realization of these design principles the prototype application IN:SHOP is employed to proof the relevance of the technologies for architecture. IN:SHOP illustrates an approach to Tele Reality in shopping areas and connects geographically distant persons and locations. The introduction of video systems in combination with databases and networking technology into shopping environments liberates from known commercial pressures, leads to novel communication channels between customers and goods, and combines one-to-one services. Networked shops equipped with cameras, sensors, and actors to acquire information offer the customer more comfort and an adaptive advisory service (Lang 2005).

Conclusion

We believe that the seamless integration of media and communication technologies will play an important role in designing contemporary architecture and will broaden the field of architecture. We hope that our research and findings will help us and others to further explore spatio-temporal considerations in architectural design. Practical experiments and presentations to experts from the industry and discussions confirm our assumptions.

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