İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

AMBIENT INTELLIGENCE AND ITS EFFECT ON ARCHITECTURAL SPACE

M.Sc. Thesis by

Ceren HANCIOĞLU, B.Arch

Department : Architecture

Programme: Architectural Design

JUNE 2006

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SUMMARY

Future visions of architects are influenced by other disciplines. If anything can be certain about the future of architecture, it is that the influence of technology, especially digital technology and ambient technology, will continue to grow and to profoundly change how we express ourselves, how we communicate with each other, how we live in space, and how we perceive, think about and interact with our world. Technology guides us for future and defines the way we live, perceive and communicate.

The combination of Digital Technologies, Information Technologies and Communication Technologies surely constitute Ambient Intelligence (AmI). AmI is an important component that frames the scope of this study. As described in European Symposium on AmI in Eindhoven Netherlands 8-10 November 2004, AmI represents a vision of the future where we shall be surrounded by electronic environments, sensitive and responsive to people.

This thesis focuses on the possibilities offered by the emerging field of ambient technology like flexibility and interactivity and its effect on architecture. Defining the new meaning of existing and the degree of transformation of space is the challenge in this thesis. The big impact of ambient technologies on architecture is its ability to transform our experience of space totally.

Following the introduction, second chapter begins with descriptions of AmI and AmI Technologies. Then develops with the discussions of new interfaces of AmI and scenarios created by researchers. The third chapter begins with discussions on relations between Architecture and AmI. Then develops with discussions of architects about future of architecture with AmI. The main approaches of the thesis “transformations of space with AmI” take a big part in this chapter. In this part architectural representation in new projects analyzed and also thoughts of architecture students as the architects of future collected with a questionnaire and evaluated. This research structuralized in three different titles to emphasize on different views. These are technology producers’ view, architects view and view of architecture students as architects of the future.

If we understand what is happening, and if we can conceive and explore alternative futures, we can find opportunities to intervene, sometimes to resist, to organize, to legislate, to plan, and to design.

As architects we have to give more value to the space that surround us, we have to capture the flexibility and interactivity opportunities given by AmI Technologies. Environments and products have greater variety, flexibility, embedded intelligence, and functionality. As architects we have to discuss about the transformation of space after technological development. The space is no longer static; it’s more dynamic and transformable.

KAPSAYAN ZEKA TEKNOLOJİLERİ VE MİMARİ MEKANA ETKİLERİ

ÖZET

Mimarların gelecek vizyonları diğer disiplinlerden etkilenir. Gelecekteki mimarlık anlayışı için kesin olan bir şey varsa oda teknolojilerin özellikle Kapsayan Zeka ve Dijital Teknolojilerin etkisinin giderek genişleyeceği ve kendimizi nasıl ifade ettiğimizi, nasıl iletişim kurduğumuzu, mekanda nasıl yaşadığımızı ve bulunduğumuz dünyayı nasıl algıladığımızı, düşündüğümüzü ve etkileştiğimizi değiştirecek olmasıdır.Teknoloji bizi geleceğe yönlendirir ve yaşama sanatımızı, algımızı ve iletişimimizi tanımlar.

Dijital Teknolojiler, Bilgi Teknolojileri ve İletişim Teknolojilerinin kombinasyonu Kapsayan Zeka kavramını oluşturur. Kapsayan Zeka bu tez çalışmasının kapsamını oluşturan en önemli bileşendir. Eindhoven, Hollanda'da 8-10 Kasım 2004 tarihinde gerçekleştirilen Kapsayan Zeka Avrupa Sempozyumunda Kapsayan Zekanın duyarlı ve yanıt veren elektronik çevrelerle sarıldığımız bir gelecek vizyonu sunduğu belirtilmiştir.

Bu tez Kapsayan Zeka Teknolojilerin gelişen alanı içinde mümkün kılınan fleksibilite ve interaktivite kavramlarını ve bunların mimarlık üzerindeki etkilerini tartışmaktadır. Bu tez sözü edilen teknolojilerin yarattığı mekan transformasyonu ve yaşayış biçimlerinin değişimine odaklanmıştır. Kapsayan Zeka Teknolojilerin mimarlık üzerindeki en büyük etkisi mekan deneyimimizi tamamen değiştirmesidir.

Giriş bölümünü takiben, ikinci bölüm Kapsayan Zeka ve Teknolojilerini tanımlamakla başlar ve araştırmacılar tarafından geliştirilen yeni Kapsayan Zeka ara yüzleri ve bu teknolojilerin geleceğini öngören senaryoların tartışılması ile gelişir. Üçüncü bölüm mimarlık ve Kapsayan Zeka Teknolojilerinin arakesitlerini tartışır ve buluşma noktalarını tartışır ve mimarların Kapsayan Zeka Teknolojilerinin gelişimi ile mimarlık kavramının nasıl değişeceği konusundaki görüşleri ile şekillenir. Bu tez çalışmasının ana yaklaşımı "mimari mekan transformasyonu" tartışmasıdır. Bu bölüm mimarların ve araştırma laboratuarlarının geliştirdiği projeleri analiz eder ve bölüm sonunda yer alan anket ile mimarlık öğrencilerinin yeni Kapsayan Zeka Teknolojileri konusundaki düşüncelerini toplar ve analiz eder. Bu araştırma farklı görüşleri vurgulamak açısından üç başlık altında gerçekleştirilmiştir. Bunlar teknoloji üreticilerinin bakış açıları, mimarların bakış açıları ve geleceğin mimarları olarak mimarlık öğrencilerinin bakış açılarıdır.

Eğer neler olduğunu anlayabilir, düşünebilir ve alternatif gelecekleri keşfedebilirsek, müdahale etmek, bazen karşı durmak, organize etmek, planlamak ve tasarlamak için farklı olanaklar bulabiliriz.

Mimar olarak bizler çevremizi saran mekana daha çok değer katmalıyız ve burnun için Kapsayan Zeka Teknolojilerini bize sunduğu fleksibilite ve interaktivite gibi olanaklardan yararlanmalıyız. Artık çevremiz ve kapsadığı ürünler büyük varyasyonlar, fleksibilite, gömülmüş zekalar ve fonksiyonellik içermektedir. Mimarlar

olarak teknolojik gelişimlerin sunduğu mekan transformasyonunu tartışmalıyız. Mekan artık statik değil, daha dinamik ve dönüştürülebilir.

1. INTRODUCTION

Architects have a chance to influence the society by offering alternative life styles and statements presented in their products. Future visions of architects are influenced by other disciplines like science, technology, cinema, art, engineering and etc. As architects, we must notice that our creativity is threatened by vision bombardments from all disciplines. To attain a more creative mind architects must explore other disciplines and look for new connections between architecture and rest of the world.

Technology is a kind of culture, and it surely appears as a dominant mode of our life styles. Technology guides us for future and defines the way we live, perceive and communicate. In that sense we can say that technology is turning into a popular companion of architectural design in recent years.

If anything can be certain about the future of architecture, it is that the influence of technology, especially digital technology and ambient technology, will continue to grow and to profoundly change how we express ourselves, how we communicate with each other, how we live in space, and how we perceive, think about and interact with our world.

The combination of Digital Technologies, Information Technologies and Communication Technologies surely constitute Ambient Intelligence (AmI). AmI is an important component that frames the scope of this study. As described in European Symposium on AmI in Eindhoven Netherlands 8-10 November 2004, AmI represents a vision of the future where we shall be surrounded by electronic environments, sensitive and responsive to people. The main challenges of AmI researchers are:

- Augment objects/environments with sensing, computing & networking capability
- Integrate digital world (information & services) and physical world (physical objects/environment)

This thesis focuses on the flexibility and interactivity opportunities offered by the emerging field of ambient technology and its effect on architecture.

The big impact of ambient technologies on architecture is its ability to transform our experience of space totally. Defining the new meaning of existing and the degree of transformation of space is the challenge in this thesis. As architects we have to give more value to the space that surround us, we have to capture the opportunities given by AmI Technologies like flexibility and interactivity.

The combination of the two themes mentioned above Architecture and AmI shapes the basis for the discussion of this thesis. Can this particular blend of divergent themes help us to attain a more creative mind to interpret and overcome this obscure period of future, and influence our mutual future with technology as architects?

This thesis concerned on symbiosis of physical and virtual, new life styles of future and especially the transformation of physical space with the technologies mentioned above. This thesis is not focused on digital design or virtual architecture or CAD systems, it is focused on how digital, information and communication technologies will affect our styles of living and experiences of space with the theme of AmI which connects these technologies. This thesis is a reading over new design concepts, lifestyles of future and connection points of physical and virtual and after all; transformation of space with the emerging field of AmI technologies.

The method of this thesis is to analyze AmI Technology, scenarios of AmI futures especially the ones supported by European Union and then architects' ideas about future of architecture with AmI and examine their projects to understand the transformation of space. To figure out an architectural future, also ideas of architecture student as architects of future are collected by a questionnaire about emerging field of AmI.

This thesis focused on an unexplored meeting point of divergent themes like new technologies and architecture to figure out a vision of future of architectural space. It is clear that various configurations could have been possible in such an attempt. The attempt will be to integrate pieces of personal and collective brainstorming on these themes for a general panorama.

2. AMBIENT INTELLIGENCE (AmI)

2.1. Definitions

Main Entry: [1]**am·bi·ent**

Pronunciation: 'am-bE-&nt

Function: adjective

Etymology: Latin ambient-, ambiens, present participle of ambire to go around, from ambi- + ire to go

: existing or present on all sides: ENCOMPASSING

Main Entry: [2]**ambient**

Function: noun

: An encompassing atmosphere: ENVIRONMENT

Ambient means existing in the surrounding area, especially of environmental conditions – according to the definitions given in Cambridge Advanced Learner's Dictionary –.

Main Entry: **in·tel·li·gence**

Pronunciation: in-'te-l&-j&n(t)s

Function: *noun*

Etymology: Middle English, from Middle French, from Latin *intelligentia,* from *intelligent-, intelligens* intelligent

1 a (1) **:** the ability to learn or understand or to deal with new or trying situations **:** **REASON**; *also* **:** the skilled use of reason (2) **:** the ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria (as tests)

b *Christian Science* **:** the basic eternal quality of divine Mind

c : mental acuteness **:** **SHREWDNESS**

2 a : an intelligent entity; *especially* **:** **ANGEL** **b :** intelligent minds or mind <cosmic *intelligence*>

3 : the act of understanding **:** **COMPREHENSION**

4 a : **INFORMATION**, **NEWS** **b :** information concerning an enemy or possible enemy or an area; *also* **:** an agency engaged in obtaining such information

5 : the ability to perform computer functions

Intelligence means ability, the ability to learn, understand, and think about things

– according to the definitions given in Cambridge Advanced Learner's Dictionary –.

We usually think of ambience in terms of the delightful surroundings like favorite restaurants. But restaurant ambience and Ambient Intelligence are two very different things. Philips Electronics defines AmI as “The presence of a digital environment that is sensitive, adaptive, and responsive to the presence of people.”

Following this description AmI is a communicating networking of physical environments and the objects within them, their relationships to you, each other and the space. (Philips Research, 2001)

Figure. 2.1 Infrastructure for AmI, 2006

(image from www.fokus.gmd.de/bereichsseiten/geschaeftsfelder/smart_environment)

The vision of AmI first proposed by Philips Research back in 1999 is now, in some shape or form, a significant part of scientific research around the world. It has been an important theme in Philips Research’s collaboration with the Massachusetts Institute of Technology (MIT), in particular in MIT’s Oxygen project, which is developing technology for the computer of the 21st century. Another alliance with INRIA and Thomson Multimedia has resulted in the initiation of a special project called AmI Research and Development, which is developing software platforms for AmI applications in the home. (Philips Research, 2001)

In addition to these initiatives, AmI has also won significant financial backing from the European Union. During a series of workshops organized by the Information Society and Technology Advisory Group (ISTAG), which serves as an influential advisory board to the European Union, Philips’ vision of AmI was adopted in 2001 as the leading theme for the Sixth Framework on IST Research in Europe. This will

result in a European research programme, with a budget of 3.7 billion Euros over the coming four years and dedicated to the topic.

2.2. AmI Technologies

AmI is the evolution of technology, communication and cognition towards the future of human-computer interaction (HCI). AmI technologies are expected to combine concepts of ubiquitous computing and intelligent systems putting humans in the centre of technological developments. Surely AmI is a combination of Information Technologies (IT), Digital Technologies and Communication Technologies.

AmI represents a long-term objective for European research bringing together researchers across multiple disciplines: computer science, electronics and mechanical engineering, design, architecture, social sciences, software engineering, to name a few.

An Alcañiz and Rey state, AmI builds on three recent key technologies: Ubiquitous Computing, Ubiquitous Communication and Intelligent User Interfaces. Some of these concepts are barely a decade old and this reflects on the focus of current implementations of AmI. Ubiquitous Computing means integration of microprocessors into everyday objects like furniture, clothing, white goods, toys, even paint. Ubiquitous Communication enables these objects to communicate with each other and the user by means of ad-hoc and wireless networking. An Intelligent User Interface enables the inhabitants of the AmI environment to control and interact with the environment in a natural (voice, gestures) and personalized way (preferences, context). (Alcañiz and Rey, 2005)

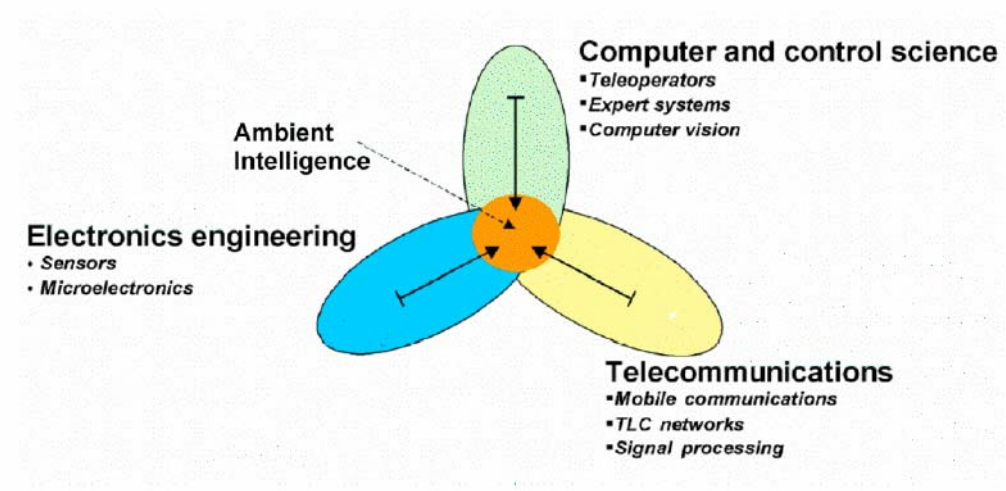

Figure. 2.2 AmI by Alcañiz and Rey, 2005

AmI Technology as described by Maes (2004) is:

Invisible:

- Use/functions are immediately apparent

Ubiquitous:

- Available anywhere, integrated in physical environment & objects around us

Intelligent:

- Relevant to user & context-aware
- Unobtrusive
- Providing meaning (vs. knowledge vs. information)

Researchers radically rethink the human-computer interactive experience.

- Integrate digital world (information & services) and physical world (physical objects/environment)
- Make interfaces more responsive and proactive (objects & environment monitor user and (proactively) present information & services relevant to user's current needs/interests)

Researchers of AmI's challenge are:

- Augment objects/environments with sensing, computing & networking capability
- Sense & model the user's behavior (offline/online)
- Infer the user's current interests/intentions
- Design (proactive) interfaces that offer value without being obnoxious, while being highly relevant
- Integrate these interfaces in user's physical environment in seamless, natural way:

o On the body: cell phones, wearable

o In the environment: architecture, ether, objects

As mentioned by Riva (2005), AmI is the effective and transparent support to the activity of the subject/s through the use of information and communication technologies.

Entertainment, communication and information are starting to move back out of the virtual world and return to the real world. As mentioned by Philips Research (2001), AmI is at the heart of this change in interaction and functionality. Devices will

become more able to react in a smart way with the goal to provide ease of use and greater support for our lifestyles.

The vision of AmI is characterized by two key features: intelligence and embedding. The feature of “intelligence” refers to the fact that the digital environment is able to analyze the context, adapt itself to the people and objects that reside in it, learn from their behavior, and eventually recognize as well as express emotion. The feature of “embedding” means that miniaturized devices will increasingly become part of the invisible background of peoples’ activities, and that social interaction and functionality will move to the foreground. (Riva and others, 2003)

Gaggioli (2005) argues, AmI (AmI) will radically change how people interact with technology. In AmI, people will be surrounded by a multitude of interconnected embedded systems. These devices will be able to locate and recognize objects and people, as well as people’s intentions.

According to this vision, people will not just use technology: they will live with it.

As described in European Symposium on AmI in Eindhoven Netherlands 8-10 November 2004, AmI represents a vision of the future where we shall be surrounded by electronic environments, sensitive and responsive to people.

The future society mentioned in AmI descriptions is called Information Society. Defined by the EC ISTAG (2001) in a vision of the Information Society, AmI emphasizes on greater user-friendliness, more efficient services support, user-empowerment, and support for human interactions.

2.3. New Interfaces For AmI

In 1999, the Advisory Group to the European Community's Information Society Technology Programme ISTAG, issued a proposal for a new paradigm–the AmI. The AmI approach intends to tie together ubiquitous computing, ubiquitous communication and intelligent HCI.

In four scenarios, this program showcases ideas on how IT might be deployed and experienced in 2010 (ISTAG, 2001). In those futuristic visions, which will be discussed in part 2.4.1 in this thesis, humans will be surrounded by lots of physical devices that are interconnected by seamlessly mobile and fixed communication infrastructure. That is, instead of sitting in front of a machine, the machine will be all around us. Moreover, interactions between you and such a system will be through

natural feeling human interfaces, which recognize, respond and learn our presence and preferences.

ISTAG gives a more formal definition of AmI (AmI) that points out how it should provide technologies to surround users with intelligent sensors and interfaces and to support HCI.

The objective of AmI is to broaden the interaction between human beings and digital IT through the usage of ubiquitous computing devices. AmI implies a seamless environment of computing, advanced networking technology and specific interfaces. Cantoni (2005) argues, aside from the HCI problem, another important issue is that the actual configuration, bound to computers with flat rectangular screens, windows, keyboards and a mouse, do not seem to embrace the real power of IT".

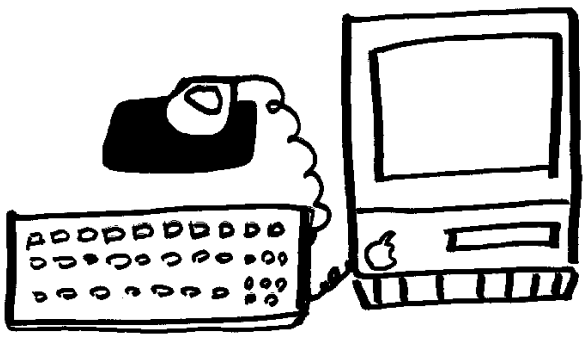

Figure. 2.3 Screens, windows, keyboards and a mouse are not the interfaces of information societies. (image from http://tell.fll.purdue.edu)

If we look at the new trends of man-machine interfaces, one solution that has become very popular, is to immerse the user completely within a virtual world –in a similar way to what happened to the actor Jeff Bridges, who was sucked into a computational domain in the movie "Tron: An Electronic Odyssey (1982)" (Figure. 2.4).

In virtual reality research the locus of interfaces alternates mainly in two directions: wearable and immersive environments.

In the first, the idea is to 'pack' the entire surface of your body with a matrix of small tactile sensors and vibrators –hundreds of them by cm2.

Figure. 2.4 Tron: An Electronic Odyssey, 1982

(image from http://www.imdb.com/title/tt0084827/)

Another less invasive option is to immerge in a hardware controlled CAVE (Cave Automatic Virtual Environment), the walls of which consist of huge projection screens. CAVEs are cubical rooms of variable dimensions with walls formed by panoramic projection screens. Over the screens, computer synchronized video projectors create a single projection field that wraps the interactors with images and 3D sounds. In this system, you are asked to wear a kind of stereoscopic glass with a track device that helps to generate a 3D personal perspective of the scene (Fig.2.5).

S. Piva and others (2005) state in A Flexible Architecture for AmI systems aim at augmenting real environments to create Smart Spaces where users are provided with pervasive virtual services. In order to allow users to seamlessly complete their tasks across a multitude of smart devices, and across different physical locations, the AmI infrastructure must be complemented with ubiquitous Intelligent User Interfaces able to adapt the interaction to their characteristics and needs.

Cantoni (2005) states, virtual worlds are collections of computer-generated binary information. They are accessible through technological interfaces that, in the current dominant user interface paradigm, produce a perceptive effect of making users believe they are typing on virtual paper in a flat rectangular screen.

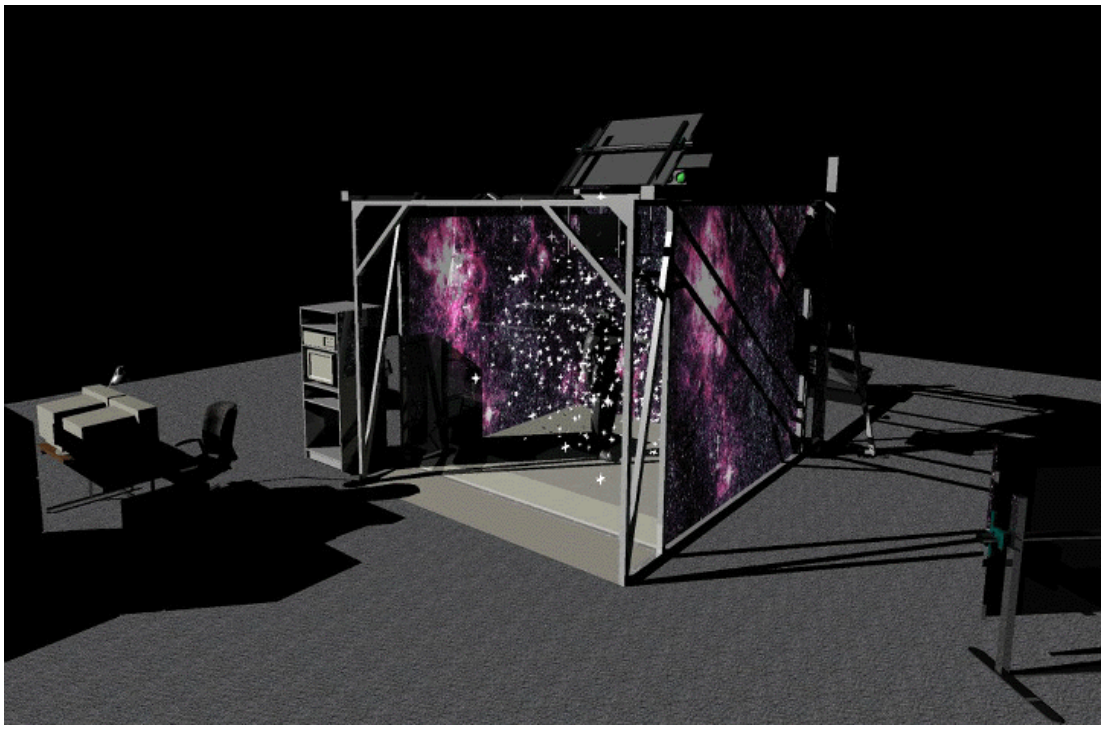

Figure. 2.5 A typical CAVE

(image from http://www.sv.vt.edu/future/vt-cave/VT/images/VT-CAVE1.gif)

According to Weiser (1995), one way of thinking ubiquitous computing is to imagine a totally new design for computers. Designed out of their plastic boxes, 'ubiquitous' computers are projected to cause the sensation of living in an extended world filled with invisible engines. In such a world, users would be surrounded by thousands of network interconnected systems designed to satisfy their needs for information, communication, services and entertainment.

Examples of ubiquitous computers are tabs, pads and boards. Tabs are clip-on computers with small screens and track sensors that help to identify themselves to receivers placed throughout a building. This attachment permits people or objects to be localized. Pads were conceived to function as scrap paper. Spread out like sheets of paper over a table, this device has no individual use –anyone can take one and use it anywhere. (Cantoni, 2005)

Other research projects that pursue to achieve similar goals are tangible bits and augmented reality.

In tangible bits, the challenge is to transform everyday objects such as doors, tables, books, lights or even the flux of air and water into computational interfaces. According to the director of Tangible Media Group at the MIT Media Lab, Hiroshi Ishii (1997), these interfaces would enable you to access and manipulate digital data

(videos, graphics and 3D models) using nothing more than the innate knowledge you have acquired dealing with physical objects of the real world: “If you can pick up a mothball, you can run Ishii's computer”.

The ‘computer’ developed by Hiroshi Ishii and his team is a small room, augmented with lights, sound, air and water flow that are all controlled by a computational system (Figure. 2.5). In this space, patterns of light projected from the surface of moving water reflect on the lab’s ceiling to communicate the activities of a hamster (the lab’s pet). Other light and sound signs (e.g. bird songs and thunder) signal incoming e-mails. And other Net traffic and past activity can be retrieved by turning back the hands of a physical clock.

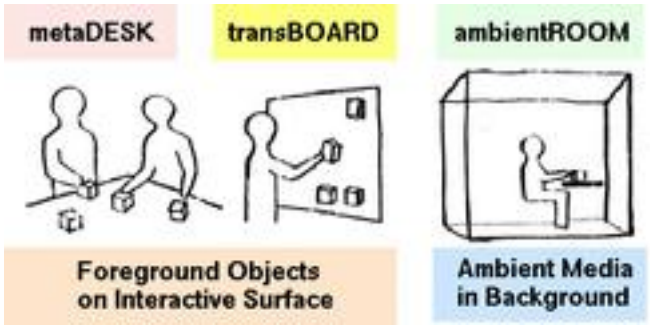

Figure. 2.6 Ishii’s computer, 1997 (image from www.media.mit.edu/tangiblebits)

In augmented reality, the hybridization of physical and virtual spaces is accomplished through devices designed to overlay graphics, texts and other computational data to the interactor’s perception of the environment.

Inspired by those ideas, Cantoni is developing a prototype, which he has named Bodyarchitecture. ‘Bodyarchitecture’ is a research platform, investigating different forms of natural, multimodal HCI. It involves the research and development of computer vision, speech and gesture recognition systems that connect media and physical spaces to what its inhabitants are, and do and say. Following the AmI paradigm, it was conceived to be invisible to the user, so that you can communicate and interact with it in a natural way. (Cantoni, 2005)

Cantoni (2005) argues in Bodyarchitecture: the Evolution of Interface towards AmI;

> We cannot see things or relate to people who are not linked to the system. The missing liaison between the physical environment and the data world –between atoms and bits- oblige us to interact in parallel, i.e., in one or the other space. In this case, following the AmI paradigm, the main challenge is to build practically ‘invisible’ interfaces (i.e. interfaces built in a human centered manner) that are capable of overlaying virtual data to the physical world, instead of recreating it inside a computer.”

The projected physical installation of Bodyarchitecture is a 3x3m empty room furnished with six LCD projectors (four covering the walls, one the floor and one the ceiling), ten video cameras (four used by computer vision systems and six to display external information), an audio stereo system and an array of computer controlled devices – temperature and pressure sensors and motion detectors (Figure. 2.7-2.8).

A sample interaction with this system as described by Cantoni (2005) would be:

• You walk into a room. It is three meters across by three meters long and three meters high

• The walls are blank and two-dimensional. As you walk in, the thump of your feet

alters the balance of the inert space until you reach the center

• Now, your body activities are transcribed to the walls, i.e. the walls begin to move (it seems) in a three dimension, fluid manner

• Add to that, a hidden audio stereo system that 'pulls' your body sounds – the beating of your heart, the pace of your breathing, the frequency of your voice- and you will get the picture of the kind of architectonic impact the increasing complexity of changes may cause.

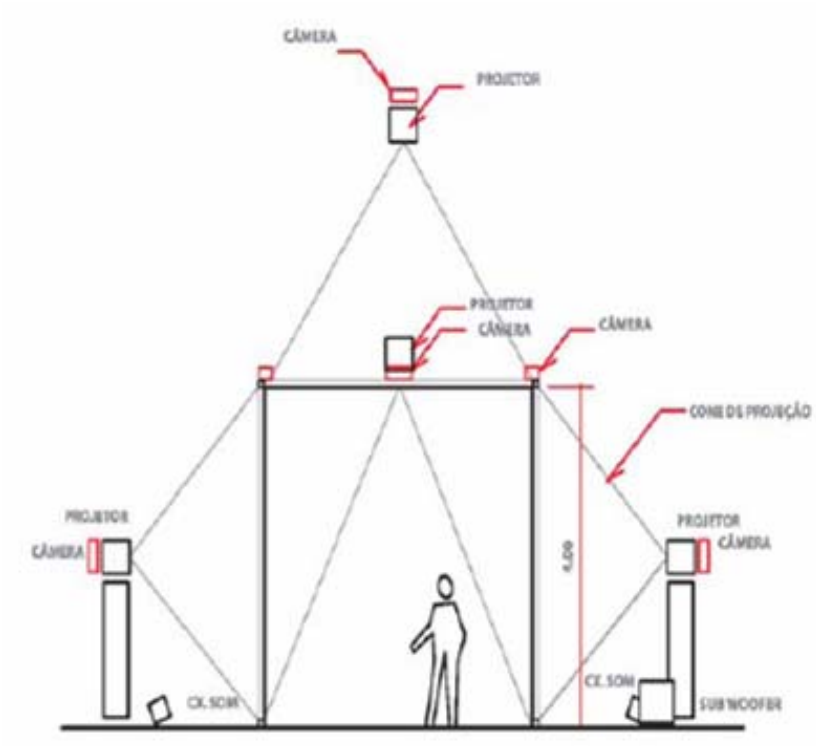

Figure. 2.7 Section of Bodyarchitecture by Cantoni, 2005

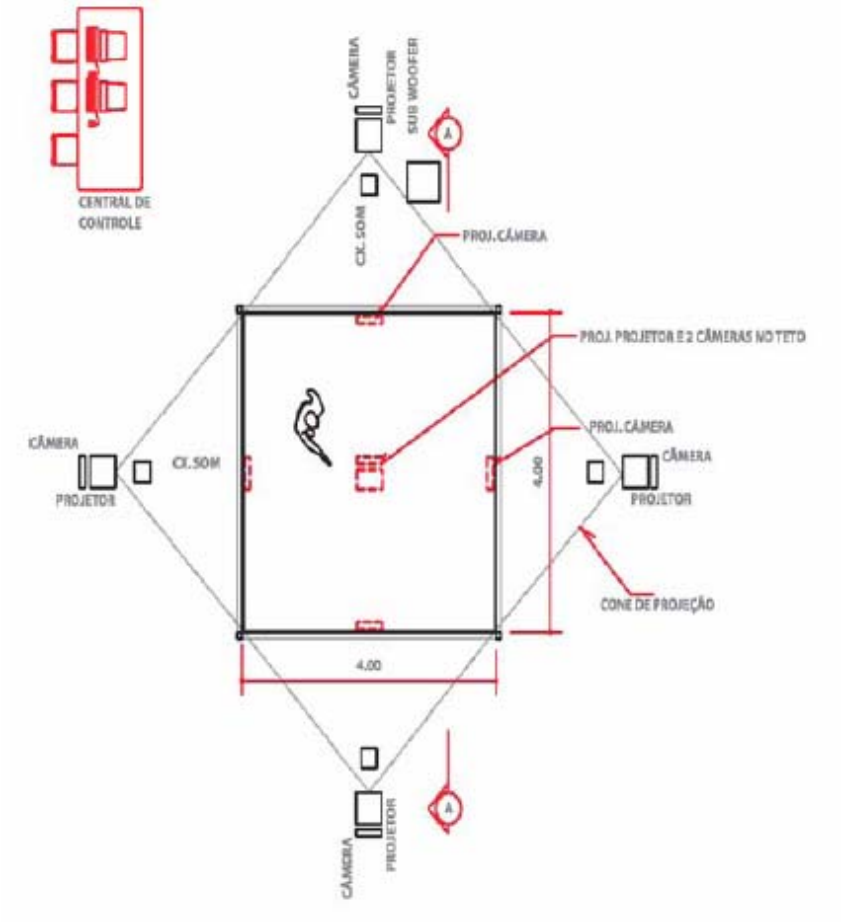

Figure. 2.8 Plan of Bodyarchitecture by Cantoni, 2005

2.4. Scenarios For AmI

Films portraying the future often contain visions of homes of the future. Fitted out with an array of intelligent devices, these homes can anticipate your every need. They are usually depicted as existing within wider smart infrastructures. These infrastructures boast intelligent transportation systems and seamlessly integrate services from health to shopping and from entertainment to law enforcement. As these scenarios realized in movies also researchers are developing scenarios to give a shape to new technologies like AmI. As mentioned by ISTAG “Change is fast and it is up to as entrepreneurs and technologists to engage in constructing the future: these things won’t happen automatically.”

ISTAG does not think it necessary to more tightly define the term AmI. But it is important to appreciate that AmI remains an ‘emerging property’ and that future scenario building and iterations of the vision should treat AmI as an ‘imagined concept’ and not as a set of specified requirements.

The Scenarios were planned to explore the future technologies that are implied by the vision of AmI. In implications of AmI, they considered the industrial-business, economic and socio-political aspects to penetrate technologies deeper into the daily life and work of people.

ISTAG and MIT are not the only group developing these scenarios for future. Different research laboratories and also architects like Mitchell in “City of Bits-1995”, “E-topia-2001” and Negroponte in “Being Digital-1995” has developed different scenarios and they are still developing. In this part of the thesis ISTAG and MIT research’s scenarios selected to discuss. Architects scenarios will be discussed in part 3.2.2 with the exampled projects.

2.4.1. ISTAG Scenarios for AmI in 2010

The European Commission Community Research made a research in 2001 about User-friendly information societies called “ISTAG Scenarios for AmI in 2010”.

The scenarios developed by IPTS (part of European Commission’s Joint Research Centre) in collaboration with DG Information Society and with the active enrolment of 35 experts from across Europe. The aim was to describe what living with “AmI” might be like for ordinary people in 2010.

The scenarios are traditional explorations of the research group but offer provocative glimpses of futures that can be realized. As they explain (2001) “People in Information Societies are surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects and an environment that is capable of recognizing and responding to the presence of different individuals in a seamless, unobtrusive and often invisible way”. In this way of thinking, each scenario has a script that is used to work out the key developments in technologies, society, economy, and markets necessary to arrive at the scenario.

The vision of people benefiting from services and applications whilst supported by new technologies in the background and intelligent user interfaces was essentials to the ISTAG notion of AmI in the first place. They also underline the place of AmI in serving and the community as well as individuals.

The scenarios generated a number of key results. As a brief description of work of ISTAG;

Socio-critical factors: They believe that AmI should facilitate human contact, oriented towards community and cultural enhancement, help to built knowledge and skills for work, citizenship and consumer choice, and should be controlled by ordinary people.

Their work is to abstain from the idea “them controlling us”.

Key technological requirements: The technology timelines for each of the scenarios were explored. On the basis the following technology requirements for AmI identified:

- very unobtrusive hardware
- seamless mobile/fixed communications infrastructure
- dynamic and massively distributed device networks
- natural feeling human interfaces
- dependability and security

Research clusters: On top of these largely generic technology requirements, major research clusters emerged from the work of the scenario-building group.

- AmI is compatible enabling hardware- including optical networks, nono-micro electronics, and power and display technologies.
- AmI open platforms- for interoperating networks based upon o corporate effort to define a “service control platform”
- Intuitive technologies- involving efforts to create natural human interfaces
- AmI developments in support of personal and community development- including socio-technical design factors, support for human to human interaction and the analysis of societal and political development.
- Metacontent services developments are to improve information handling, knowledge management and community memory, involving techniques such as smart tagging systems, semantic web technologies, and search technologies.
- Security and trust technologies are in support of privacy safety and dependability.

According to ISTAG, product design will emerge for new intersectoral collaborations strategic alliances due to multidisciplinary, multisectoral competences required.

The first scenario is basically depending on developed versions of laptops, mobile phones and personal assistants. The character in the scenario is wearing “p-com” on her wrist. P-com is dealing with ID and visa checks in airport, makes reservations of hotels, and rents car as owner’s personality. The hotel rooms adopt the personality of its new guests. Room temperature and default lighting are set and there is a display of selected video and music choices on the video wall.

The second scenario is also depending on personal wearable and embedded technologies in environment. The character is wearing, embedded in his clothes, a gateway or "digital avatar" of himself, known as "digital me, D-Me". As defined by ISTAG "D-Me is a people-based, ad-hoc networking device registering, processing and offering information on private lives. It is aimed at facilitating socially based networking and relations, at offering communication interfaces and at taking decisions in specific situations on behalf of the wearer". Moreover, D-Me is connected to other D-Me's and partly share the information inside. Furthermore, it creates a wide collective virtual space of potential human interaction.

The third scenario is showing AmI environments and effects on how people do their shopping and the way they move around the city in this environment. In this scenario, urban infrastructure has been upgraded to support telematic transport and environmental management. Information of object is more important than the object itself. Devices are unobtrusive, intuitive and secure. In this scenario, ISTAG wanted to re-conceptualize transport network and real-time demand of goods distributed. The city re-conceptualized as an organizational system work. The character in this scenario makes plans for her travel this day and AmI helps her finding a vehicle to share on that way by searching the trip database. In the car route guidance systems warns for traffic jams and calculates alternative ways with trip times. In addition, the system alerts the driver for potential accidents.

And networked system of devices at home and the environment is shown in this example like when she plans to make a dinner to her friends and needs a recipe e-fridge gives her the recipe including the missing goods in this recipe and orders them to be delivered to the closest distribution point in her neighborhood. As described in scenario "This can be a shop, the postal office or a franchised nodal point. All goods are smart tagged, so that she can check her virtual shopping expedition, from any enable device at home, the office or from a kiosk in the street." Even if the point is closed, she can take her goods from smart delivery boxes in this point.

This scenario assumes a radical redesign of the urban system, especially the transportation of people. The AmI here leads to a much more efficient and user friendly urban environment.

2.4.2. MIT Research Scenarios for AmI

The MIT course "MAS.961 Ambient Intelligence", provides an overview of a new vision for HCI in which people are surrounded by intelligent and intuitive interfaces

embedded in the everyday objects around them. It focuses on understanding enabling technologies and studying applications and experiments, and, to a lesser extent, it addresses the socio-cultural impact. The students were asked to come up with new ideas and start innovative projects in this area. These scenarios are published on course's website "http://courses.media.mit.edu/2005spring/mas961/ ".

The daily life of information societies are represented in their papers focused on mostly personal wearable technologies which are in a network with space.

Personal wearable: In every student scenarios, the augmented computer systems that can be wearable or implemented described as the main idea. These systems connected to every system in the house also in the city. For example, Amy Eastment's personal wearable able you see the weather report in closets display and warns you the bus is only a few stops away when you are close to your closet to wear something. Aaron Zinman is personal wearable is an implementation of a system called Brain-Computer Interfaces (BCI). With a BCI, the display, which is a wire to eyeglasses, enables to get information about where you are looking, what you hear, your attention status, level of cognitive processing. Eye eyeglasses are for augmented realities.

The space: The scenario papers of students focused on personal wearable computers, augmented eyeglasses, active agents for everyday activities, networked connections of intelligence objects all over the environment. The spaces described as augmented spaces with agent systems, digital displays.

Aaron Zinman describes the network with space and his wearable computer (BCI) like "doors unlock themselves, objects and walls move when I need more space, and the lighting is always at the right level and direction. Because it is so automatic, I never feel unease about the dynamism of my environment".

As Amy Eastment's and Aaron Zinman's descriptions, every equipment in kitchen is connected to each other and the owner's personal wearable. Kitchen agent founds some recipes for cooking and keeping inventories of what is low. Appends a list of needed ingredients, and sends an order to the store. In addition, it can link into other functions such as notifying guests when the meal might be later than a specified threshold.

Virtual whiteboards for phasing the bits as teacher speaks, active search agents helps you searching an interesting topic that you are interested in the classroom as described by Amy Eastment. And she is talking also about an experimental campus network enables the students to categorize their friends and then inform them when

they are in close proximity which reminds me the book 1984 written by George Orwell about the “big brother” watching you every time and everywhere.

2.4.3. Philips Research Scenarios for AmI

Philips Research has developed some scenarios of future living including some visualization about the space. In these scenarios augmented environments with implemented technologies emphasized.

Figure. 2.9 The Hospital of future by Philips Research, 2006

(image from www.research.philips.com/password/archive/23/pw23_ambintel_scen1.html)

In first scenario a daily life in a hospital represented. Implemented technologies represented as wearable and embedded in architectural spaces.

“I used to be scared of hospitals and doctors. For the last two weeks I’ve had a nasty cough and had to go through all kinds of tests. But this time, I was as brave as Nemo and I did not cry, not even once.” A result that Julie’s mother also helped realize by telling the doctors how much she adores cartoon images of fish. Now, the lung specialist visits July and checks the latest diagnostic images. Julie, however, is too busy chatting with her friends to speak to him. But that’s okay. He has to visit her neighbor anyway, at which point the fish images on his coat change to little teddy bears.. And when the nurse comes by, the screen on Julie’s bed will let her know the medication he just prescribed.

In second scenario a trip represented. Also in this scenario implemented technologies and info screens emphasized.

Figure. 2.10 The trip of future by Philips Research, 2006

(image from www.research.philips.com/password/archive/23/pw23_ambintel_scen1.html)

Just got on the train and wonder where you should sit? Well, simply look at the yellow lights above the seats to find out which ones are free. But since you want to doze a bit, you should first check the intensity of the illumination under the adjacent seats, as these indicate the activity of their occupants. On the windows, you can look up general information on the villages you pass and preset the songs on your media player. Better select a long play list, the girl thinks as she checks her electronic ticket. It shows her the train she's supposed to get on at the next village is running fifteen minutes late.

In third scenario a daily life at home represented. In this scenario implemented technologies and new communication technologies emphasized.

What is more inspiring than the skyline of New York? View of the Serengeti plains perhaps? Solid-state lighting that is integrated in furniture and walls, assumes the color of the dry grass, making the people feel as if they could almost get up and walk over to the elephants. "Mom, won't his tusks get in the way while he is drinking?" little Andy asks while he opens an Internet window with more information, simply by pointing at the elephant. Meanwhile, Jack and Jane, their best friends who just moved to Miami, join in to watch the program they used to watch together when they were neighbors.

Figure. 2.11 The daily life at home of future by Philips Research, 2006

(image from www.research.philips.com/password/archive/23/pw23_ambintel_scen1.html)

New arguments on architecture point a new fact that architecture no more follows function but fiction to create a vision of future. Constructing fictions in order to achieve a progressive architecture will empower us be more critical about the modes of how we live and how we perceive in future. To be able to advance according to this approach, as architects we have to be capable of analyzing any form of fiction and scenarios having various aspects.

These scenarios are important for architects to know because they are showing how people live, leisure, travel, shop and work in future. These developments which they are talking about applied to office, home, and automobile contexts are the first portents of AmI.

3. AMBIENT INTELLIGENCE'S EFFECTS ON ARCHITECTURE

3.1. Relations Between Architecture and AmI

As Maes (2004) states, AmI envisions a world where people are surrounded by intelligent and intuitive interfaces embedded in the everyday objects around them. Following Maes' description about AmI, embedded everyday objects includes all architectural spaces. As architects we have to think about the life style of information societies and architectural space embedded with these technologies.

AmI systems aim at augmenting real environments to create Smart Spaces where users are provided with pervasive virtual services and connected with IT changing how we communicate. (Piva, 2005)

What does it matter? Why we should care about this new kind of architectural and urban design issue? It matters because the emerging civic structures and spatial arrangements of the digital era will profoundly affect our access to economic opportunities and public discourse, the forms of cultural activity, the enaction of power, and the experiences that give shape and texture to our daily routines…If we understand what is happening, and if we can conceive and explore alternative futures, we can find opportunities to intervene, sometimes to resist, to organize, to legislate, to plan, and to design. (Mitchell, 1995)

Why it concerns architects? AmI is the vision that all architects use to denote this new paradigm in architectural space. Comprehension and perception of space, materiality and time is changing with these researches. According to the vision statement of ISTAG, "converge humans will be surrounded by intelligent interfaces supported by computing and networking which is everywhere, embedded in everyday objects such as furniture, clothes, vehicles, roads and smart materials even particles of architectural environment".

How it will affect the space? The awesome buttons and menu options of present-day equipment will disappear, to be replaced by intelligent systems that we operate through user interfaces that are extension of our architectural space. Following this definition, buildings have to be connected with the technology embedded to it and have to be a part of information access circle.

AmI researchers are designing augmented environments with interfaces embedded in user's physical environment supporting the use of information and communication technologies.

The new communication systems radically transforms space and time…Localities become disembodied from their cultural, historical, geographic meaning, and reintegrated into functional networks, or into image collages inducing a space of flows that substitutes for a space of places. (Castells, 1996)

How we work with AmI in space? Application of AmI in industrial innovation needs new products like houses, workspaces, furniture, hospitals, schools adapted to this technology.

The connection points between Architecture and AmI as discussed in this thesis is the aim of both territory: interfaces and coterminous territories of virtual and physical places.

3.2. Discussions on Architectural Space After AmI

The big impact of ambient technologies on architecture is its ability to transform our experience of space totally.

Space is no longer seen as fixed place surrounded by bricks and mortar, but rather as a virtual form which presents the structure of information. "Physical and virtual architecture have entered a state of symbiosis. Information has irreversibly expanded the dimensionsionality of architecture". (Schmitt, 1999)

A new set of conditions for the design of architecture has emerged as a result of the digital revolution as argued by Smart Cities Research Group in MIT Media Lab. IT, low-cost sensing, low-cost computation, CAD/CAM, and innovative materials have changed the rules. As a result, environments and products have greater variety, flexibility, embedded intelligence, and functionality. Mass customization has surpassed mass production. Such environments would allow for movable wall partitions, connectivity and interchangeability among electronic systems, complex spatial configurations, intelligent plumbing and mechanical systems, and adaptive packaging and integration of consumer products.

3.2.1. A Look from Technology Producers View

Researchers are investigating methods for merging new technologies with person-centered design. They are generating new ideas, technologies, and methodologies that support the creation of innovative products and services that satisfy the emerging and future needs of people as they live in their homes. This broad research approach is leading to innovative product ideas that are unlikely to be uncovered in more narrowly focused industries or research endeavors.

We can look at any number of homes of the future via our always-on broadband connections. Whether it is MIT's House_n, Philips' HomeLab, Georgia Tech's Aware House, or Ericsson's intelligent condominiums, each offers compelling glimpses of what's being researched now and what's around the corner. These projects are prepared with more concern on technology then the architectural design.

People worked on the projects searching on new techniques to embed technology to traditional shape of family houses for near future. They did not concern about the life style and space which also will change after new communication, IT and AmI technologies.

3.2.1.1. Philips HomeLab

Philips has one of the Research Lab's constructed in the Philips High Tech Campus in Eindhoven, The Netherlands called HomeLab.

Philips' own commitment to AmI is typified by its investment in HomeLab – a home that is also a laboratory, not a laboratory that is also a home. Ultimately however, in Philips' vision of AmI, AmI is not about technology but about people, because it is not AmI that will shape the future of ordinary people, it is ordinary people who will shape the future of AmI – by making decisions on how they want their lives to be changed.

Philips Design researchers' approach is to enhance people's lives, they want to know and fully understand how people interact with technology. They want to learn from people so they can make sure their innovations work for people. The HomeLab is a proof point for their dedication to this in the context of Philips' AmI vision.

HomeLab has been designed to allow studies of novel system concepts, which today may still require a lot of equipment to realize, but which can be expected to become compact enough to disappear in the background in the near future. It allows studies of distributed home networking systems which require connecting different rooms and floors as found in a real-home environment.

Figure. 3.1 Philips Home Lab by Philips, 2002

(image from http://www.research.philips.com/technologies/misc/homelab/)

'HomeLab', it is built in a different style and has a different appearance. But when going through the front door you enter the hall of a normal house. The two-stock house has a living, a kitchen, two bedrooms, a bathroom and a study. Interior atmosphere matches a modern one family home as closely as possible. At a first glance, the home does not show anything special.

In the home of the future as described by Philips, electronics will be seamlessly integrated into your home with built-in flat-screen monitors, wireless connections and voice or gesture recognition, so that you will hardly notice its presence. This is part of what Philips calls "AmI," which means technology that can think on its own and react to (or, possibly even predict!) your individual needs so that you don't have to work to use it.

Philips created HomeLab to test its new home technology prototypes in the most realistic possible way; the facility is essential in speeding up the time-to-market for technological innovation. The prototypes range from electronics that recognize your voice and movement to digital displays within the bathroom mirror to new "toys" that help will children expand their creativity. HomeLab is currently testing a number of technologies:

DreamScreen Project

The DreamScreen project studies how wall- and window-sized video and audio will be used in the future to create immersive experiences. Transforming for example windows into display surfaces will enable a range of new applications and services,

including true home theater and replacement of real views by more attractive virtual ones.

DreamScreen test set-up has been created in HomeLab, over the full (9 m) width of its living room windows, with images, video, and directional sound.

Figure. 3.2 Dream Screen by Philips, 2003

(image from http://www.research.philips.com/technologies/misc/homelab/)

Fitness Coach

With the Fitness Coach, user feedback is the gift that keeps on giving. Using smart sensors, the Coach monitors physiological signals and calculates training intensity. The Coach turns the physical feedback into data that users interpret, helping them determine the success of their training regimens.

In scenario studies for next generation fitness applications, sensors in a body-area network provide live feedback on exercise performance.

Figure. 3.3 Virtual Fitness Coach by Philips, 2003

(image from www.research.philips.com/technologies/syst_softw/ami/fitnesscoach.html)

Physical Markup Language (PML) - When your room becomes your browser

Philips has developed a common language for describing experiences within an AmI environment: PML. An AmI system can interpret a description in PML in such a way that the devices in its network can jointly use their individual capabilities to render that experience at a given location.

In effect, your whole room becomes a 'browser' that brings the experience to life. As exampled by Philips Research, PML-enabled lights add to the experience by getting brighter or dimmer or changing color. A PML-enabled hi-fi provides an appropriate soundscape. Almost any device can be PML-enabled: the possibilities are only limited by the imaginations of their manufacturers. Suppose a room is rendering an

experience described as 'warm and sunny': the lights, the TV, the central heating, the electronically controlled blinds and (a little further into the future) even the ceiling, walls and floor coverings could all contribute to creating it.

Figure. 3.4 PML - When your room becomes your browser by Philips, 2003 (image from www.research.philips.com/technologies/syst_softw/pml/images/little_red_riding_hood.jpg)

Comprising a fully equipped home, complete with living, sleeping and kitchen facilities, HomeLab will be equipped with a distributed embedded infrastructure in which AmI can be developed and investigated.

3.2.1.2. MIT House_n

To facilitate studies, a unique "living laboratory" residential home research facility called the MIT-TIAX Place Lab constructed near Massachusetts Institute of Technology. House_n (2000) is a Department of Architecture research consortium at the that explores how new technologies, materials, and strategies for design can make possible dynamic, evolving places that respond to the complexities of life.

The mission of the House_n Consortium is to conduct research by incrementing and building real spaces that can be used to study the interaction between people, technology, and design.

As described MIT, House_N (2000) designed to be a highly flexible and multi-disciplinary observational research facility designed explicitly for the scientific study of people and their interaction patterns with new technologies and home environments.

Figure. 3.5 House_n by MIT, 2000

(image from http://www.andrew.cmu.edu/user/gej/Images/House_N.jpg)

The PlaceLab is a highly instrumented apartment-scale shared research facility where new technologies and design concepts can be tested and evaluated in the context of everyday living. Not a prototype and not a demonstration environment, the PlaceLab allows researchers to collect fine-grained human behavior and environmental data, and to systematically test and evaluate strategies and technologies for the home in a natural setting with volunteer occupants. The PlaceLab is capable of accommodating multiple and simultaneous experiments proposed by academic researchers and MIT industrial collaborators.

Figure. 3.6 House_n: embedded computational technology, MIT, 2000

(image from http://architecture.mit.edu/~kll/projects.jpg)

MIT Media Laboratory created House_n to test its research in different collaborations and disciplines in different research groups as described below with the information in Media Lab's website " http://architecture.mit.edu/house_n/".

Figure. 3.7 House_n: innovative user interface applications, MIT, 2000 (image from http://web.media.mit.edu/~emunguia/html/House_n%20Research_files/PlaceLab-sm.jpg)

Changing Places

Changing Places is a joint Architecture and Media Laboratory Consortium that includes House_n and emphasizes links between the home and places of healing, work, learning, and community.

Hundreds of sensing components installed in nearly every part of the home, which is a one-bedroom condominium in a residential building. These sensors will be used to develop innovative user interface applications that help people easily control their environment, save resources, remain mentally and physically active, and stay healthy. The sensors will also be used to monitor activity in the environment so that researchers can carefully study how people react to new devices, systems, and architectural design strategies in the complex context of the home.

Ambient Intelligence

The goal of the Ambient Intelligence research group is to radically rethink the human-machine interactive experience. By designing interfaces that are more immersive, more intelligent, and more interactive they are changing the human-machine relationship and creating systems that are more responsive to people's needs and actions, and that become true "accessories" for expanding our minds.

Responsive Environments

The Responsive Environments group develops new sensing modalities and enabling technologies that create new forms of interactive experience and expression. Their work is highlighted in diverse application areas, which range from interactive music systems and wearable computers to smart highways and medical instrumentation.

Tap-Track Technology: The Responsive Environments research group has designed, built, and fielded a system that locates the position of knocks and taps on a large sheet of glass. Like the system in Minority Report (the computer) and The Matrix (the control room of Zion)

Distributed Network: Connecting Anything, Anywhere, Anytime

Based on the House_n chassis/infill system, an architectural scale model is being constructed to develop and test distributed network concepts. In this project, each building component has embedded computational technology that allows newly-introduced devices to announce their presence on the network, and to take on functionality according to their location in the structure and their physical relationship to other components.

Smart Architectural Surfaces

This project examines the creation of modular computational elements which can be used to build smart rooms, linked meeting rooms, and other sensor- and display-equipped intelligent spaces. These units are intended to tile the walls of a room, and act as a scalable, self-organizing system. Each tile incorporates networked communications, sensing, intelligence, and actuation/display. Cells coordinate their operations in order to provide complex sensing and display applications. This is a joint project between the Media Laboratory and the Information and Communications University (ICU) in Korea.

Figure. 3.8 House_n: traditional shape of a house, MIT, 2000

(image from http://www.andrew.cmu.edu/user/gej/Images/)

Nevertheless, also in this project the shape and the content of the house is same just implies new technology and comes with these questions;

With ambient technology, file to factory techniques, new materials and new design techniques, why do we have to think about a house in the same and traditional shape?

3.2.2. A Look from Architectural View

Philips and all research laboratories' vision of AmI connect in the same idea that AmI is a multi disciplinary research area and architecture is a part of the research.

Above we saw the discussions on life styles for the future with AmI in the scenarios prepared by ISTAG, MIT and projects from research laboratories. After looking from the technological view, as architects we have to discuss about the transformation of space after technological development. The space is no longer static; it's more dynamic and transformable.

How do we design a flexible and interactive architecture which can effectively support new life styles and communication functionalities and represents new technologies? To figure out the future of architecture we have to discuss on examples of architectural spaces designed to adopt AmI and designed to support new life styles after AmI.

As the scenarios created by ISTAG and MIT discussed above also architects are creating scenarios of future living.

Negroponte storied (1995) a new life and discussed it in his book "Being Digital". He asks: If it really could look out the electronic window of my living room in Boston and see the Alps, hear the cowbells, and smell the (digital) manure in summer, in a way I am very much in Switzerland. If instead of going to work by driving my atoms into town, I log into my office and do my work electronically, exactly where is my workplace?

He continues his stories representing the emerging field of AmI, future rooms will know that you just sat down to eat that you have gone to sleep, just stepped into the shower, and took the dog for a walk. A phone would never ring if you are not there. If you are there and your digital butler decides to connect you, the nearest doorknob may say, "Excuse me, Madam," and make the connection… If your early morning flight to Dallas is delayed, your alarm clock can ring a bit later and the car service automatically notified in accordance with traffic predictions.

According Negroponte's scenarios Schmitt (1999) states, IT opens new communication possibilities by transporting data and information between different persons, between persons and machines, and between different machines. IT therefore has the potential to augment and improve human communication.

As our bodies morph into cyborgs, the buildings that house them are also transforming. Increasingly, telecommunication systems replace circulation systems,

and the solvent of digital information decomposes traditional building types. One by one, the familiar forms vanish. Then the residue of recombinant fragments yields up mutants. (Mitchell, 1995)

Mitchell argues (1995) that in a world of ubiquitous computation and telecommunication, electronically augmented bodies, postinfobahn architecture, and big-time bit business, the idea of a city is challenged and must eventually be reconceived. Computer networks become as fundamental to urban life style as street systems. Memory and screen space become valuable, sought after sorts of real estate. Much of the economic, social, political, and cultural action shifts into cyberspace. As a result, familiar urban design issues are up for radical reformulation.

At the threshold of communication and information era, Mitchell reimagines the city of future with these keywords:

Circulation system [telecommunication system]

Bookstores [bit stores]

Stacks [servers]

Galleries [virtual museums]

School [virtual campuses]

Hospitals [telemedicine]

Department stores [electronic shopping malls]

Banking chambers [atm]

Work [network]

Architects of the twenty-first century will still shape, arrange, and connect spaces (both real and virtual) to satisfy human needs. They will still care about the qualities of visual and ambient environments. They will still seek commodity, firmness, and delight. But commodity will be as much a matter of software functions and interface design as it is of floor plans and construction materials. Firmness will entail not only the physical integrity of structural systems, but also the logical integrity of computer systems. And delight? Delight will have unimagined new dimensions. (Mitchell, 1995)

At the turn of the century, it is the information revolution that is metamorphosing architecture and urban design. Digital technologies are transforming the nature and intent of architectural thinking and creativity, blurring the relationship between matter

and data, between the real and virtual and between the organic and inorganic and leading us into an unstable territory from which rich, innovative forms are emerging. (Zellner, 1999)

A discussion by Schmitt (1999): What does it mean when information needs no physical means to be transported? What does it mean when people do not to move physically to their offices during most of the week anymore? What does it mean when gravity is no issue? The answer to these questions will shape the future architecture and the future city.

Several designers and researchers have addressed these questions. John Frazer, Head of the School of Design at the Hong Kong Polytechnical University, has investigated alternative forms of cities and buildings for a number of years and summarized his thoughts in the book An Evolutionary Architecture (Frazer, 1995). William Mitchell has written extensively about the future city in the information territory in City of Bits (Mitchell, 1995) and E-topia (Mitchell, 1999). Negroponte has written about future living of information societies in Being Digital (Negroponte, 1995).

Mitchell (1995) stated that we are entering an era of electronically extended bodies living at the intersection points of the physical and virtual worlds, of occupation and interaction through telepresence as well as through physical presence, of mutant architectural forms that emerge from telecommunications-induced fragmentation and recombination of traditional architectural types, and of new, soft cities that parallel, complement, and sometimes compete with our existing urban concentrations of brick, concrete, and steel.

Stated by Mitchell (1995), architects will increasingly confront practical choices between providing for bodily presence and relying on telepresence. They will be forced to explore the proper respective roles of physically constructed hardware and symbolically encoded software, and of actual space and virtual places. And eventually they will find new ways to accommodate human needs by recombining transformed fragments of traditional building types in a matrix of digital telecommunication systems and recognized circulation and transportation patterns.

> New building will be designed as to be present both on the net (global site, website) and on their location (local site, building site). Architecture is perfectly suited to become the medium to fuse the real and the virtual into a new enhanced feeling of the “here and now”. The building body will become the hyperbody. Establishing a hyperlink between real and virtual worlds, between the imagination and the tactile, between the

> here and the there, between the you and the me, wherever or whatever you are. (Oosterhuis, 2000)

And architects like Kas Oosterhuis and Lars Spuybroek are working in new architectural design concepts using the new opportunities mentioned by researchers like Mitchell, Schmitt and Negroponte given by emerging AmI technologies. E-motive Architecture, Swarm Architecture, Programmable Architecture, Hyperbodies and Trans Architecture are new architectural concepts which ambient technology and emerging digital technologies are bases and technological supports of these concepts.

For Oosterhuis (2000) the building body communicates through a sensory skin. The body feels, hears, smells, and sees, tastes. The building body will act much in the same way like the biological body. Architecture always had an array of sensory equipment attached to its body. Traditionally, doors and windows open to let people in, and to let fresh air in. Building bodies always did exchange information with their environment. But always in the analogue way. But now we have entered the era of digital evolution and the new digital technologies invade the building bodies. Exchange of information will be performed on a digital platform.

In an inaugural speech on receiving the chair of Architectural Design at the Faculty of Architecture, Delft University of Technology: Kas Oosterhuis (2001) explains new architecture;

> Electronically: The living environment will be electrified; it has sensors and detects everything around it. This is data-driven architecture
>
> Motive: The building will be motive; using kinetic structures it will be able to react real on the inputs it gets. This enables behavior, the mind and body become one and a new organism is born.
>
> Emotions: The building will have behavior, so complex the building will be an organism. Buildings become an organism with emotions.

After the emerging idea of information societies, the information of object becomes more important than object itself.

Cities and buildings were made of physical materials in the past. Instruments were made of physical material ass well. In the information age, both instruments and buildings will have higher information content, as information is the new material. Information is also an additional dimension of architecture. This duality in the meaning of information will have a fundamental impact on future designed on the built environment- architecture and the city. (Schmitt, 1999)

Oosterhuis (2000) states: All matter, including all material where architecture is made of, is being redefined as information flow. Matter is information, architecture is information. Architecture always was information, but now we start to work with architecture as information.

E-Motive Architecture in Kas Oosterhuis' own words (2001-b) in an inaugural speech about a topic "E-Motive Architecture, interactive architecture in real time" is based on the notion that buildings feed on information, process information and transmit information in a different form. Buildings are seen as input-output devices. E-Motive buildings are seen as push-and-pull instruments. It is fair to say that E-Motive buildings find themselves in a state of continuous processing. The individual building elements behave like birds in a swarm. These building elements always keep an eye on the neighboring part of the building, always ready to act and react on each other, their users and the bio-climatic circumstances. E-Motive Architecture is the art of building transaction spaces. Oosterhuis (2003-b) states;

> "Embedding Information and Communication Technologies (ICT) in built environments implies that all building elements are behaving like birds in a swarm. They exchange data in real-time. They are aware of each other, they communicate with each other. Each building element is seen as a sender, a processor and a receiver. The technique to achieve this is readily available. You must realize that the embedded swarming intelligence is physically a miniature and is as a consequence hardly visible as such. But communication between the building elements is not the whole story. These building elements behave like intelligent agents, and communicate with the users of the building. In fact e-Motive architecture builds upon the alliance between people and the building actuators".

In his view of Swarm Architecture, Kas Oosterhuis (2003) implies that all building elements operate as intelligent agents, data-carriers and data-processing devices. Swarm architecture feeds on data generated by social transactions in the new transformation economy. Architectural bodies interact with databases [people, websites, buildings, tables] in real-time and their shape and content changes all the time.

Architecture no longer has a static end-configuration. The city with its all contents is aware of each other. They communicate with each other. They are all hyper bodies.

> Architecture becomes the art of building prototypes for fluid dynamic structures and environments running in real-time. Architecture no longer has the hidden agenda to resist to external and internal forces. Buildings are pro-active hyperbodies displaying

> real-time behavior. Buildings are familiar but unpredictable like the weather. Architecture goes wild and e-motive. (Oosterhuis, 2003-b)

Architecture finally becomes truly time-based; it is no longer a simulation, not only in the isolated sectors of the design process but in the experience of the space itself. Space in Swarm Architecture communicates actively with the users of the space in real time: they know each other, they flock together, space and people are becoming linked through a complex series of networks. The knowledge of people is only meaningful because of the connections with other brains. There does not exist something like an independent brain. Knowledge, consciousness, wisdom, innovations, emotions, they all are only possible by their connection to other people.

Architecture becomes a game and as described by Kas Oosterhuis (2003): "Architects are the programmers of this game. Architecture changes in a matter of seconds into art simply by transporting it to another scene. Architecture is the programmable hyper-body played skillfully by its masters with the speed of life".

> Let's face it: due to the emergence of the distributed power of computation architecture will never be the same again. Let's face it: architecture will no longer remain static as it has been for thousands of years. Finally architecture will become liquid. And not only as a metaphor in the design process, but in real life and in real-time. Architecture goes on the move. The built structures will become programmable and will be programmed to move. It is as simple as that. Once we have the technology to do so, we will find the need to set architecture in motion, to make architecture responsive and adaptable to changing circumstances. First, we will programme the projects to respond to changing weather conditions. And then, as we architects will become aware of our power to play with the new tools, architecture will transform into the art of the game. Architects will design buildings as interactive games. Architects will become game developers. (Oosterhuis, 2000)

3.2.2.1. MIT Media House

The Media House Project (2004) is a strategic alliance between the metapolis group from Barcelona, the MIT Media Lab, and the Fundacio Politecnica De Catalunya, with the collaboration of the consortium I2CAT and the Elisava Design School, in order to build a prototype of an informational house.

The main aim is to distribute of intelligence in space taken into consideration of social, human and strategic scale of the knowledge of dwelling in new technologies and citizen networks.

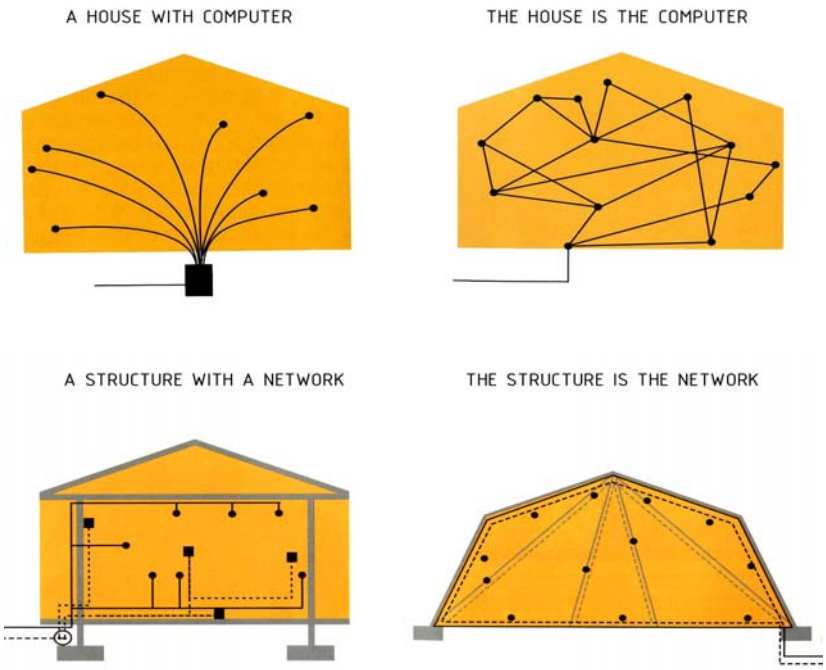

Figure. 3.9 Informational house diagrammed by Media House designers, 2004

For answering a series of questions about impact of the mass arrival of information in the field of the dwelling and to develop “the house”, which includes both the design of spaces and objects and the development of software, Media House in MIT Media Lab defined 22 layers. The people responsible for supervising these layers set out to define specific areas of development with the potential to take on a life of their own beyond the “Media House”

These layers as explained by the researchers of MIT Media House Project in the book Verb Matters edited by Manuel Gausa and others (2004) are;

Space

World=City-House > If the home is a place to live, work, leisure, shopping and rest, is the house a microcity? How do we design a multifunctional house? How do natural, artificial and digital spaces interact?

Data use house > How can a house be designed to ensure a total flexibility of uses?

Teleworking > Where do people telework? How do people telework? Is there a specific space for this?

Play place > If the house is a place to leisure, how do we play at “1:1 scale”?

Car room > is the car another space for the house, connected to it and its environment? How the streets interact and respond to intelligent cars?

Chroma room > Does the house have a space for immersive video-conferencing? Is there a commercial exploitation of virtual spaces?

Media Kitchen > How does a kitchen have to be for us to learn from it? What knowledge do we generate when we cook and eat?

Landscreens > Does the house have virtual windows in the form of natural or artificial landscapes?

Ergonomics > How is information ergonomics integrated as a physical ergonomics?

Technology

Filament (Media Lab) > Can all of the objects be connected to one another, without a hierarchy? Is the house a computer?

Human house interface > through what interfaces do we relate to "intelligent houses"? How do we control the flows of information between the physical and the digital world?

Wired House > How does information reach object and spaces? What new wiring does the house incorporate?

Intelligent objects > what are intelligent objects or furniture like? Are they physical icons of their digital behavior?

Artificial Intelligence: House to House (H2H) > How does a house think? How does the house incorporate machine-learning algorithms? How does one house relate to another?

Sustainable housing > How much energy does a re-informed house consume? What systems of recycling does it use?

Reactive surfaces: IN-OUT > Can we think of spaces that modify their size in relation to their activity? How do we construct a sensitive surface?

Web House > what is the web site of a house? What functions does it perform? Will Web sites be created for each five thousand million houses in the world?

Shaping Technology > could we think about shaping rather using technology? How to integrate rudimentary personal fabricators to the home?

Society

Social Internet > what new social relations does the information society produce? How are time and knowledge shared via the Net? Can buildings share facilities such as internet access?

Lab Home > is the house a library when kids and parents create knowledge?

E-House Administrators > How is the economic activity of the house managed? What is a digital butler like?

House Database > How are houses actually built in the global village today?

For answering these questions, a multidisciplinary group worked together like architects (construction of physical world), computer programmers (construction of the digital world) and audiovisual creators (construction of hybrid space).

Guallart & Cantarella (2005) states, this project enables the testing of the progression of IT beyond that of computers and integrates them into everyday life, literally looking to build computers from the components of buildings, in such a way, that the logical intelligence of a structure can grow with its physical form.

The Media House Project (2004) broaches various lines of research as a result of initial reflections and developments. Many of them will change our way of construction and living in dwelling.

The researchers of the project explain the way in which they think in the agenda for the informational home in “Media House Project” book edited by Guallart and Cantarella (2005). Cited from this book;

- Rather than a single central computer to control the house, it will have dozens implanted in all elements that are capable of receiving or emitting information. The most intelligent part of the house will not be any of the single objects it contains, but the house itself.

- A building’s various structures and networks (energy, water, information and physical) constructed using dry construction techniques, turning into an open, living, flexible reconfigurable organism.

- Each dwelling will turn to be a place that can potentially continue to manufacture itself. The materials used in the house will incorporate intelligent systems in their actual mass, thereby ceasing to be inert. They will obey rigorous principles of sustainable manufacture, in most cases using recycled materials.

Figure. 3.10 Media House by MIT, 2004

- Each dwelling will have a website to enable its inhabitants to control and optimize its vital functions, containing information about how we live, what we consume and how the different parts of the dwelling can interact in order to construct cleaner, more sustainable and efficient buildings.

- A digital counterpart to encourage increased relations between inhabitants will join the physical urbanization of neighborhood. Networked neighborhoods will collaborate with each other to create the digital city.

- Physical spaces will be extended virtually into other physical spaces connected in real time.

- As the dwelling develops its senses (sight, hearing, touch and smell), it will begin to become aware and learn to react to the request of the environment.

3.2.2.2. Trans-ports

The building conceived as a dynamic system within which there is a constant, computer-mediated interaction between users, environment and building. Kas Oosterhuis (Oosterhuis Associates) and Lars Spuybroek (of the Rotterdam office NOX) have been going on about it for years.

Trans-ports, by Kas Oosterhuis (2000), is an example of architectural investigation on the edge of physical and virtual: “trans-ports is a programmable vehicle that connects the virtual to the real.

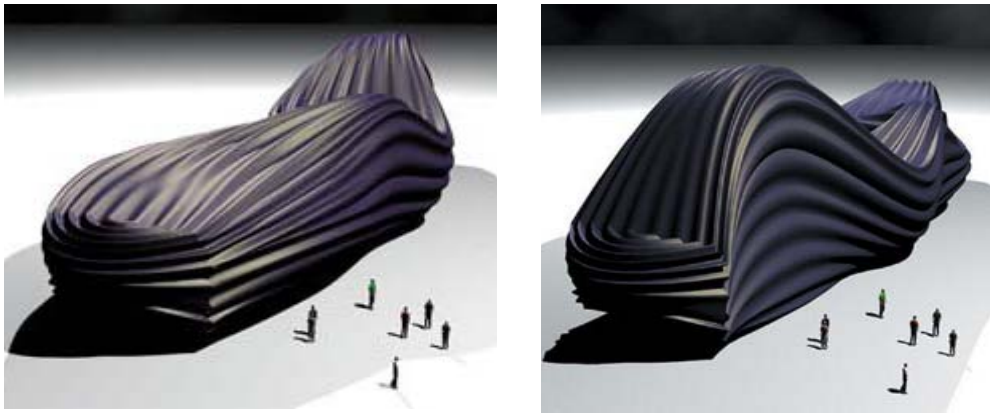

Figure. 3.11 Trans-ports by Oosterhuis, 2000

(image from http://www.oosterhuis.nl/quickstart/index.php?id=346)

The complete trans-ports network consists of a series of active structures around the world and their virtual parent structures residing on the Internet. Visitors of the www.trans-ports.com website navigate and manipulate the virtual structures, by playing the real time trans-ports game. Visitors of the Biennale2000 installation in Venice play a collective game to explore the different modes of trans-ports, the data-driven pavilion that changes shape and content in real time. The network of the real and the virtual pavilions on the internet feels like one big organism with an array of connected cells. One can seamlessly jump from real to virtual and back again. Changes in the real influence the content of the virtual and vice versa. In this way the complex of real and virtual structures is experienced as one consistent hyperbody.

> The flexible electronic skin follows the movements of the data driven structure. The skin not only displays the information of the tuning of the moment, but also lets the people interact with it. Trans-ports is the ultimate vehicle to offer valuable broadcast time to its share holder's individual and collective interaction, creating a new bond between architecture and its users. (Oosterhuis, 2000)

The active structure trans-ports digests fresh data in real time. It is nothing like the traditional static architecture which is calculated to resist the biggest possible forces. On the contrary, the trans-ports structure is a lean device which relaxes when external or internal forces are modest, and tightens when the forces are fierce. It acts like a muscle. In the trans-ports concept the data representing external forces come from the Internet and the physical visitors who produce the data which act as the parameters for changes in the physical shape of the active structures.

Figure. 3.12 Transports connects the virtual to the real by Oosterhuis, 2000

(image from http://www.oosterhuis.nl/quickstart/index.php?id=346)

The interior skin is a giant virtual window to a variety of global information sources like websites or web cams. The public is no longer looking at information, they are immersed inside information. Information is transported to the fully programmable interior skin. Through sensors the local public activates remote cameras and enters linked websites. The interior skin shapes and folds itself keeping track of the changes of the physical shape of the pavilion.

The most important feature of the trans-ports pavilion is that architecture for the first time in its history is no longer fixed and static. Due to its full programmability of both form and information content the construct becomes a lean and flexible vehicle for a variety of usage. To make all this very clear Oosterhuis have conceived six different "modes" performed by the installation at the Venice Biennale 2001:

1)"art mode": the construct is a true piece of art, content and shape programmed by visual artist Ilona Lénárd,

2)"office mode": the construct being the vehicle for showing projects by the architectural office oosterhuis ·nl,

3) "network mode" links the vehicle to the work of other designers,

4)"info mode" exploits the trans-ports vehicle for broadcasting news from the architectural frontline,

5)"commercial mode" where our sponsors feed the cave space with their commercial content, and

6)"dance mode": trans-ports transforms into a multimedia party zone.

3.2.2.3. E-motive House Project

The E-motive House Project (2002) by Oosterhuis, is fully industrial, flexible in programmability, demountable, innovative, places domestics in an other spotlight but will be general apply able in the near future.

The E-motive House is a test case for extended reality. Traditional materials are augmented with a swarm of built-in technology. The construction of the house and the furniture becomes programmable.

The structure of the E-motive House Project described by Oosterhuis is a weaving loom between a hard and a soft structure. The hard structure consists of massive wooden beams, and the soft structure is long-shaped inflatable chambers between the wooden beams. In this way, the chambers can expand and shrink to give a global shape to the emotive house. The total construction is being shaped by a spatial structure of hydraulic cylinders which are cooperating to follow or cause shape-movements. The hard structure on the exterior is covered with photovoltaic cells to generate electricity. The beams are connected with each other with pneumatic muscles, which can be contracted and relaxed. The technical challenge lies in the weaving loom of the programmable actuators and the hard structure, and in the cooperation between those actuators. They all have to work together like a flock. The scripts that need to be written are based on some simple rules for flocking behavior. The mathematical rules of behavior are known, but are never applied on structural parts.

Everything changes, except the kitchen-area and the sanitary. The form of the emotive house is a long, movable space, with on both ends the solid blocks of the kitchen and the sanitary. The space in between can be changed from workspace to eat place, to sleeping space etc

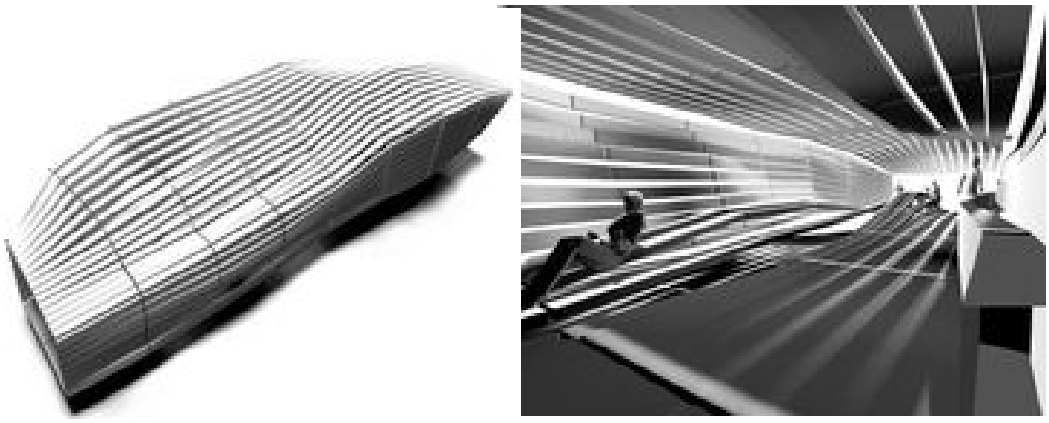

Figure. 3.13 E-motive House by Oosterhuis, 2002

(image from http://www.oosterhuis.nl/quickstart/index.php?id=348)

3.2.2.4. Water Pavilion

The building conceived as a dynamic system within which there is a constant, computer-mediated interaction between users, environment and building. Kas Oosterhuis (Oosterhuis Associates) and Lars Spuybroek (of the Rotterdam office NOX) have been going on about it for years. The commission to design the Water Pavilion, a building to house an exhibition about water on the former construction island Neeltje Jans, finally provided them with an opportunity to put these ideas into practice in a permanent structure.

Figure. 3.14 The Water Pavilion by Spuybroek (NOX) and Oosterhuis (ONL), 1994-1997 (image from http://static.flickr.com/28/47657490_bf07a1d530_m.jpg)

Water Pavilion really is: a huge and spectacular three-dimensional media artwork where form and content are intimately related. It is about 100 meters long and consists of two interlocking sections. The first section, Lars Spuybroek's Freshwater Pavilion (ca. 61 m. long) is clad with stainless steel and has a wavy, elongated, flowing form. It is followed by the Kas Oosterhuis's Saltwater Pavilion, dark grey, tapered and angular (ca. 42 m.). The far end, which also boasts the only (small) window in the entire pavilion, juts out over the Oosterschelde. The contrast between the two halves is great; whereas Spuybroek's section looks like a luminous, flexible deformation, Oosterhuis's is a dark, angular and fixed form.

The commission for the water pavilion included not just the architectural design but also the development of the program together with the client into a new type of “water experience”.

The main entrance is located in NOX's section and is positively theatrical: the rounded head of the silvery mass opens outwards in two parts. Next, a narrow, murky hall: a light sluice. The space itself puts one in mind of a glacial crevasse.

There is no distinction between horizontal and vertical, between floors, walls and ceilings. Building and exhibition have fused: mist blows around your ears, a geyser erupts, water gleams and splatters all around you, projections fall directly onto the building and its visitors, the air is filled with waves of electronic sound. Floors, walls and ceiling really do twist and turn, as can be clearly seen outside; their forms are just as liquid as the water flowing past the pavilion. The Freshwater Pavilion - or more accurately, the electronics incorporated in it - is driven by the visitors.

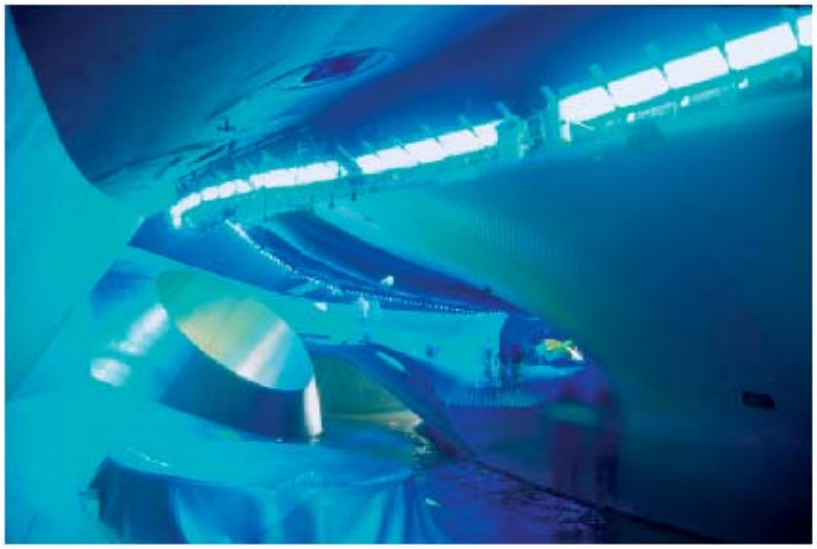

Figure. 3.15 The Freshwater Pavilion by Spuybroek, NOX, 1994-1997

(image from http://www.vitruvius.com.br/arquitextos/arq000/imagens/136_5.jpg)

As described by NOX, the pavilion's architecture was developed simultaneously with a highly innovative interactive interior hat fully involves all the senses in the visitor's experience. The architecture, which has received high international acclaim for introducing a completely new language of form, is one that ahs no horizontals or verticals, but one where space and geometry are in a state of continuous transformation and variation.

The interaction is partly based on existing water technologies like the freezing of a wall, the spraying of mist, artificial rainfall, jumping jets of water and partly on very innovative real-time electronic interactions. The building has multiple varieties of sensors through which visitor's interact with light, sound and projections. All three systems work simultaneously in such a way that local effects (like a sudden change of light) are transferred though the building using "liquid algorithms". Individually visitor's can throw "stones" in virtual ponds, or "jump" into the virtual ponds or rivers that immediately start rippling when touched. Collectively visitors can make

enormous waves of sound and light and completely alter the atmosphere and emotionally of the interior.

Figure. 3.16 The Freshwater Pavilion by Spuybroek, NOX, 1994-1997

(image from http://www.noxarch.com/flash_content/flash_content.html)

What distinguishes Oosterhuis's pavilion are the different forms of interactivity employed here. Visitors can navigate through a 3D projection he designed (and which, despite deliberately blurred edges, does not really integrate with the architecture, continuing look like a film on the wall). Moreover, external factors play a role in the 'behavior' of this pavilion. A weather station outside registers data on salinity, tide and wind gusts in and near the Oosterschelde. Processors translate these into commands that slow down or speed up the light and sound inside. They also influence the color of the light. Thus the 'biorhythm' of the building develops. As yet, it is still in its early stages. The pavilion exhibits a basal behavior which must now, according to Oosterhuis, 'become more intelligent'. His office is still working on other forms of external influence, such as the possibility of global manipulations via the Internet. In the coming years a lot more software will be added to the Saltwater Pavilion.

Figure. 3.17 The Saltwater Pavilion by Oosterhuis, ONL, 1994-1997

(image from http://www.oosterhuis.nl/quickstart/index.php?id=294)

What a reading of the Water Pavilion makes clear is that, despite some affinities, the ideas of Oosterhuis and Spuybroek differ strongly. Both architects want to create a building that is a dynamic system. But whereas Oosterhuis interprets this as a sculptural building that behaves like a living organism, this is precisely what Spuybroek does not want.

In order to affect a continuous interplay between people and building, he wants a chain reaction that is constantly out of balance. In the Freshwater Pavilion, in the absence of clearly definable floors and walls, people lose their balance and fall; this new architecture demands a new kind of behavior. The Water Pavilion is the first very large and complex, fully interactive, three-dimensional environment ever built. It is more than a quasi-interactive environment where the user can only choose from a limited number of possibilities supplied by the producer. The software built into the Water Pavilion receives so many different sorts of input that even the makers cannot predict the results. Every moment is different and unexpected. This makes the Water Pavilion not just an experience but also an unparalleled testing ground for the study of interactivity.

Figure. 3.18 The Saltwater Pavilion by Oosterhuis, ONL, 1994-1997

(image from http://www.oosterhuis.nl/quickstart/index.php?id=294)

3.2.2.5. Digital House Project

Differ from Kas Oosterhuis' approach, the project designed by Hariri&Hariri called Digital House (1998) is showing their ideas and expectations from a house of future.

Due to the advent of digital technology and global telecommunications, the architecture of the new millennium will have to accommodate working, shopping, schooling, entertainment, and physical fitness, all of which will take place at home. (Hariri&Hariri, 1998)

Hariri&Hariri explores the nature of domestic space in the future by examining the family structure, our changing habits, the intuition of marriage, children, single-sex families, communication and information technologies, work, leisure, public and private life, conceptions of body, health, and hygiene in this project. Virtual and physical, supported with new technologies and existing in space that how this feeling changes.

The Digital House Project is explained by Hariri&Hariri in their website. The architecture of the main spaces has been reduced to simple, efficient, minimal habitable units, partially prefabricated and available off the shelf. These units would plug into the steel structure of the spine, similar to an industrial shelving unit.

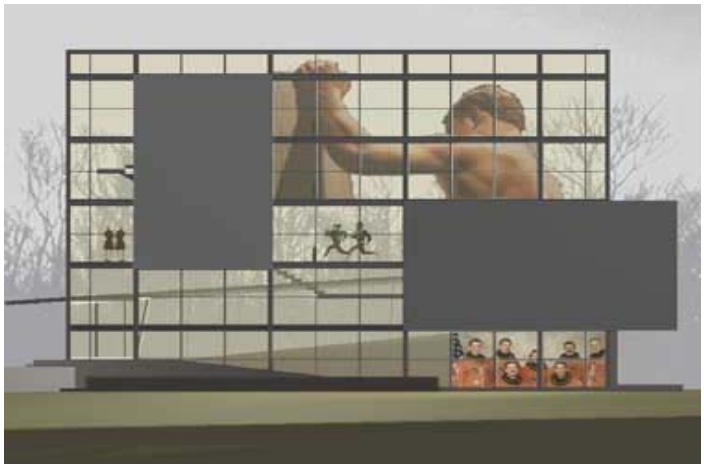

Figure. 3.19 The Digital House by Hariri&Hariri, 1998

They try to allow the family members to interact virtually but live together actually addressing the paradoxical American desire for a solitary existence and family interaction at the same time

They designed the spaces as units plugged in the digital spin and designed the inside of these spaces like the living room is where the entertainment takes place (media room). Any movie or TV program is accessible globally and could be watched at a touch (Figure. 3.19).

The office/work spaces have liquid drafting wall instead of the individual monitors and children's work/class rooms are connected to the schools around the globe.

Figure. 3.20 The Digital House: a virtual chef from a favorite restaurant by Hariri&Hariri, 1998

All the bedrooms are equipped with dream recording devices, so one could review one's dreams on the liquid wall of the room.

The kitchen/dining room operates like a laboratory with a long working counter also plugged into the spine. One can prepare the meal with the help of a virtual chef from a favorite restaurant and have a dinner with a virtual guest or friend through the liquid wall (Figure. 3.20).

And they also think about the landscape surrounds the building. The virtual landscaping however, can offer many possibilities through out the house.

3.2.3. A Look From Future Architecture Producer's View: A Case Study; What Architecture Students Think About Future of Architecture with AmI?

To figure out what kind of future is waiting for us, we have to ask architecture students to learn what they think for the future as the architects of future. Thirty three architecture students from different backgrounds and countries were asked to answer a questionnaire in which, they were asked to read the scenarios, the projects from research laboratories and projects from architects all about Ambient Technologies (AmI), Information and Communication Technologies (ICT). This research is focused on architecture students to collect the ideas of architects of the future about the emerging field of AmI and ICT.

The questionnaire includes scenarios with different themes each page. After reading the scenarios three questions were asked for each. The first question is to understand their reaction to the scenario; they are asked what they feel after reading the scenario. Are they scared or feel familiar and close to the idea of the scenario? The second one is asked to learn what they want for the future about the theme of

the scenario they read and third one is to learn what they think it will be in the future about the theme scenario. Last two is asked to learn the difference about what they want and think it will be in the future.

Participants of the questionnaire answer the questions by putting ticks on a horizontal graphic including five keywords positioned under numbers from one to ten and from minus one to minus ten. Two sides of the graphic are ten and minus ten are representing two opposite ideas. In the middle it is zero and the keyword under it is “neutral”. Keywords are prepared differently for each theme and scenario. First questions keywords are prepared to understand participant reaction to scenarios second and third questions keywords are always same to understand the difference of what they want and think it will be. The keywords of the last two questions are prepared to understand the reason of their reaction asked in the first one in the same time.

The evaluation process of the questionnaire is started putting the choices of all participants in a superposed graphic and see the density. After the first evaluation all the papers examined one by one to understand participants reactions and ideas and their reasons of their reactions.

The Structure of the questionnaire starts from the small-scale “object scale”, continues with a bigger scale “space”, at the end the biggest scale “the urban scale”, searching for answers of these questions below which are asked also by researchers of MIT, Philips and other research labs to design the future too.

Furniture

- How people interact with prototypes of intelligent technology?
- Can all of the objects be connected to one another, without a hierarchy? Is the house a computer?
- Through what interfaces do you relate “intelligent houses”? How do you want to control the flows of information between physical and digital world?

Space

- How people interact with prototypes of intelligent spaces?
- If the house is a place to leisure, how do you play at “1:1 scale”? What kind of entertainment you want in your home?
- Does the house have virtual windows in the form of natural or artificial landscapes?

- Can you think of spaces that modify their size in relation to their activity?

Society

- How people interact with each other in information societies?
- What new social relations does the information society produce?
- If the home is a place to live, work, leisure, shopping and rest, is the house a micro city? What do you think about a multifunctional house?

The First Page

The first theme is **Networked Intelligent Objects**

Depending on developed versions of laptops, mobile phones and personal assistants, ISTAG (Information Society Technologies Advisory Group) prepared scenarios which are shown in part 2.4.1 in this thesis. In the first part of the questionnaire these scenarios are the main info given to participants. Quotation from the questionnaire:

> ISTAG explain "People in Information Societies are surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects and an environment that is capable of recognizing and responding to the presence of different individuals in a seamless, unobtrusive and often invisible way". (2001)
>
> Characters in these scenarios are wearing "p-com" on their wrists. As explained P-com is a personal wearable invention which is dealing with ID and visa checks in airport, makes reservations of hotels, and rents car as owner's personality. The hotel rooms adopt the personality of its new guests. Room temperature and default lighting are set and there is a display of selected video and music choices on the video wall.
>
> In The MIT course AmI, students asked to come up with new ideas and start innovative projects in this area. The daily life of information societies represented in their papers. Aaron Zinman describes the network with space and his wearable computer (BCI) like "doors unlock themselves, objects and walls move when I need more space, and the lighting is always at the right level and direction. Because it is automatic, I never feel unease about the dynamism of my environment"

In this part of the questionnaire, people are asked to answer the main question:

"Can all the objects get connected to each other and can they work together without a hierarchy?"

Their reaction and their wishes are showing their answer to the main question.

The reaction to scenario;

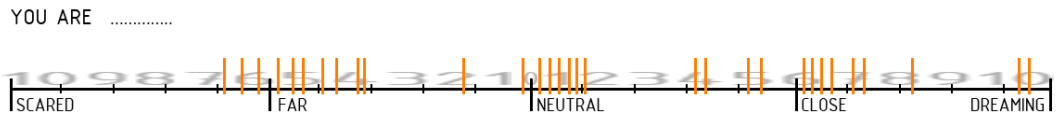

Figure. 3.21 The density of reaction to first theme first question

These orange ticks in Figure. 3.16 are showing the reaction levels of participants to the scenario they read. The density is showing that 75 % are in positive side.

40 % is feeling close to these ideas, 25 % of people are far to this scenario and 25 % is neutral, and 7 % is dreaming about this technologies and the rest 3 % is feeling far and scared about this technology.

What people want;

70 % of people want this technology makes their life easier, 11 % is neural, 11 % think this technology makes their life complicated, 3 % want to go further and share the information much more than others, and the rest 3 % want no computer at their home.

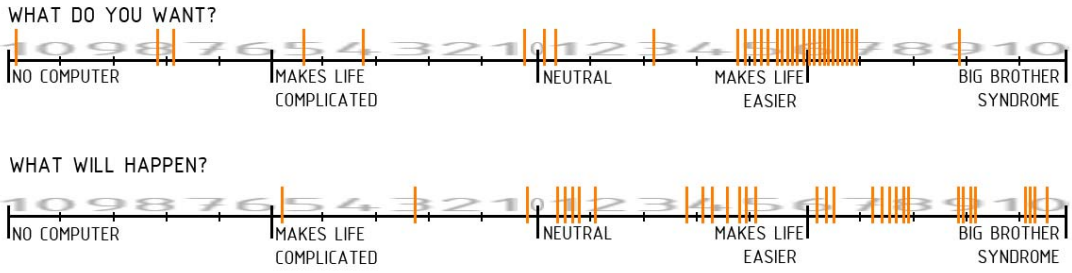

Figure. 3.22 The density of reaction to first theme second and third question

What people think will happen;

The 46 % think that it will become a big brother syndrome after sharing that much information, 30 % think our lives will be easier with this technology, 17% is neutral and 7 % thinks our lives will be so complicated.

Conclusion: The people who are far-scared to this idea, they even do not want computer in their houses because they believe that it is making their life complicated and it will become a big brother syndrome. The people who are far to this idea are mostly far to other scenarios on questionnaire about IT and AmI. The people who

are neutral to this idea, want this technology makes their life easier but believe it will be really close to big brother syndrome at the end. People who are close to this idea they want this technology make their life easier but they believe it will be like big brother syndrome.

In conclusion, architects are close to this scenario and technology and they want and believe these technologies make our lives easier but they are concerned about big brother syndrome after sharing that much information.

As architects we have to find answers of the question below to make people more familiar to these ideas represented in this scenario.

What can we do for getting away from the affair of big brother syndrome in the same time using these technologies and sharing information with everybody?

The Second Page

The second theme is **Concept Houses**

Depending on developments of concept houses of research labs like MIT House_n which is shown in part 3.3.1 in this thesis, we start to discuss the space itself also with AmI technologies. Change is accelerating, but the places we live are largely static and unresponsive. In the second part of the questionnaire these projects are the main info given to participants. Quotation from the questionnaire:

> House_N is a Department of Architecture research group at the Massachusetts Institute of Technology that explores how new technologies, materials, and strategies for design can make possible dynamic, evolving places that respond to the complexities of life.
>
> Hundreds of sensing components installed in nearly every part of the home. These sensors will be use to develop innovative user interface applications that help people easily control their environment. The sensors will be use to monitor activity in the environment so that researchers can carefully study how people react to new devices, systems, and architectural design strategies in the complex context of the home.

In this part of the questionnaire, people are asked to answer the main question “Can all of the objects be connected to one another and to the space? Then is the house a computer?” with the scenario they read. Their reaction and their wishes are showing their answer to the main question.

The reaction to scenario;

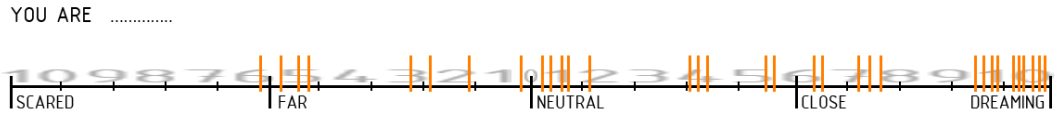

Figure. 3.23 The density of reaction to second theme first question

These orange ticks in Fig.3.18 are showing the reaction levels of participants to the scenario they read. The density is showing that 79 % are in positive side.

The 30 % of people are close to concept house made by MIT Media Lab, 28 % are dreaming about living in a house like that, 21 % are neutral, 12 % are far to this idea and %9 are far and neutral.

What people want,

The scenario is prepared to ask architects what they think about the space after these technologies. The 47 % want these technologies change the architectural space, 46 % want implemented technologies to existing house concept, 3 % want no further development and the rest 3 % is neutral to this idea.

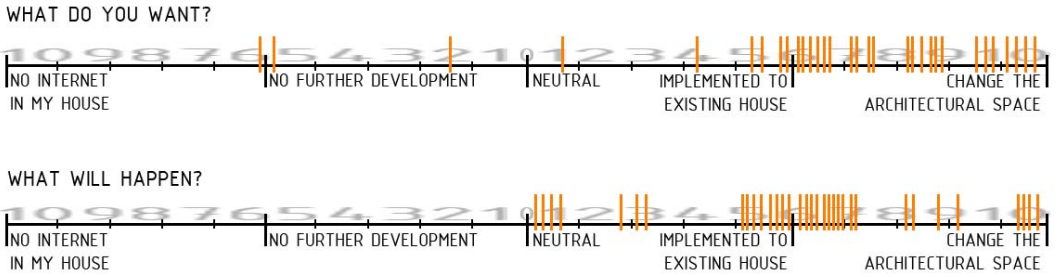

Figure. 3.24 The density of reaction to second theme second and third question

What people think will happen;

When it comes to the question that what they think will happen, 62 % believe the technology will be implemented to existing concept of house, 21 % believe these technologies will change the architectural space concepts and 17 % are neutral about what will happen.

Conclusion: The people, who are far to idea of these concept houses for future, are neutral about what they want or they want this technology implemented to existing space but believe that in future it will be implemented to existing concept of house. The people who are neutral to this idea, they want the technology implemented to

existing space but they are neutral about what will happen in the future. The people who are close to this idea, want implemented technology to existing and want to change the space too, but they believe it will be implemented to existing concept in the future. The people who are dreaming about this idea want these technologies have impact on changing the architectural space but believe that in the future these technologies will be implemented t existing concept of house and could not have that big impact on changing the architectural space.

In conclusion, most of the architects are close to this idea, dreaming about technology-adopted houses like the concept house scenarios in the questionnaire, and they want to change the architectural space with the impact of Information and Communication Technologies and AmI but they believe in the future these technologies could not have the big impact to chance the concept of house that people live today.

As architects we have to find answers of the question below as a new research after the results of the scenario.

With ambient technology, file to factory techniques, new materials and new design concepts, why do we have to think about a house in the same and traditional shape?

The Third Page

The third theme is **The Transformation of the House**

This part is prepared to learn people's ideas about the transformation of space and house after implementation of new technologies. There are two different scenarios in this part. One is a project from research lab to show how engineers think about this implementation and the other is a project from an architectural office more interested in people's lives. The project exampled in [a] part is the project explained in the part 3.3.2.1. above. The project exampled in [b] part of the questionnaire is the project explained in the part 3.3.2.2. above. Quotation from the questionnaire:

> The transformation of house [a]
>
> Media House Project, in order to build a prototype of an informational house, this project tests the progression of informational techniques beyond computers, and integrates it into everyday life. As they describe their project, "The Metapolis architects have developed an informative structure, which incorporates in just one element--a house--the physical structure and electrical and data networks that enable a dynamic

and configurable link between the entities (people, objects, space, limits, networks, contents) and that which create an inhabitable environment".

The scenario of the Media House is,

World=City-House > If the home is a place to live, work, leisure, shopping and rest, is the house a microcity? How do we design a multifunctional house? How do natural, artificial and digital spaces interact?

Landscreens > Does the house have virtual windows in the form of natural or artificial landscapes?

Car room > Is the car another space for the house, connected to it and its environment? How do the streets interact and respond to intelligent cars?

The transformation of house [b]

The physical products of cyber architecture we cannot see maybe but it is changing the way of thinking of architecture and open minds for hybrid spaces. Many of the architects are thinking about and making projects for our future.

Hariri&Hariri explore the nature of domestic space in the future by examining the virtual and physical, supported with new technologies and existing in space that accommodates how our feelings change.

House is organized around a Touch Activated digital Spine, liquid with a global network of databases. They designed the spaces as units plugged in the digital spine and designed the inside of this space, as the living room is where the entertainment takes place (media room). Any movie or TV program is accessible globally and can watch at a touch.

The office/work spaces have liquid drafting wall instead of the individual monitors and children's work/class rooms are connected to the schools around the globe.

The kitchen/dining room operates as a laboratory with a long working counter also plugged into the spine. One can prepare the meal with the help of a virtual chef from a favorite restaurant and have a dinner with a virtual guest or friend through the liquid wall.

They also think about the landscape surrounding the building. The virtual landscaping can offer many possibilities throughout the house.

"The infiltration of electronics into the vocabulary of building brings with it the capacity for connection, not only of all systems within the building, but also of the building itself to the surrounding world. As a media skin for occupants, the identity and character of the house evolves as it responds to, and stores data from, the needs and the use patterns of the occupants." (Hariri&Hariri, 1999)

The reaction to scenario;

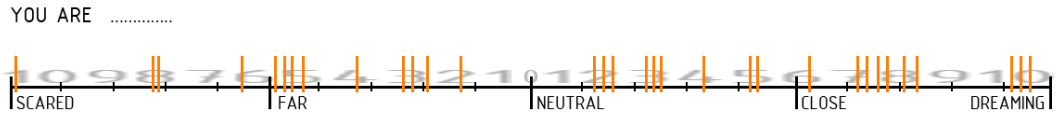

Figure. 3.25 The density of reaction to third theme first question

These orange ticks in Fig.3.20 are showing the reaction levels of participants to the scenario they read. The density is showing that 67 % are in positive side.

According to these scenarios, 27 % of people are close to idea of transformation of space after implementation of technology like the example scenarios, 21 % are neutral and close, 15 % are neutral but far, 9 % are dreaming to live in these houses, and 3 % are scared of these technology implemented and integrated of virtual and physical houses.

What people want;

The question asked for learning what kind of transformation people want. 31 % of the people answered the questionnaire, want the house and the computer system implementation and house becomes computer itself. 25 % of people want no transformation of the space. They want a house with a computer. 25 % of people are neutral. 19 % of the people want an integration of virtual and physical worlds after the implementation of the technology.

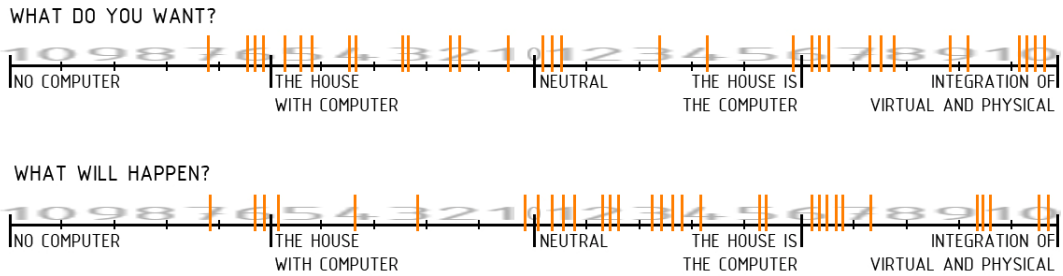

Figure. 3.26 The density of reaction to third theme second and third question

What people think will happen;

The question asked for learning what people think will happen in the future. 40 % of the people are neutral about what will happen, 25 % think the house will be the computer system itself. 19 % think the space will not transform. 16 % believe that

virtual and physical worlds will be integrated after the implementation of the technology.

Conclusion: The people, who are scared of the idea living in the houses like in the scenario, want no transformation of space and house. They want a house with a computer like the concept houses in the part two of questionnaire. The people, who are close to these ideas, want a house which has integrated computer systems and house becomes the computer itself. And the people, who are dreaming of these houses, also want integration of virtual and physical worlds.

In conclusion, when the question comes to the transformation of space after the implementations of technology, the people who want these implementations also believe that integration of virtual and physical has to occur. The space will transform. On the other hand, people who are far to the idea of transformation of space and want a house with a computer, they prefer the concept houses like the houses in the second part of the questionnaire.

As architects we have to find answers of the question below.

“Moreover, the space is no longer static. Can it be transformed at will to meet different situations and serve different functions?

The Fourth Page

The fourth theme is **The Borders of Physical and Virtual**

In the third part of the questionnaire people were asked about the transformation of space after the implementation of the technology. In the future people think transformation of the space will occur as integration of virtual and physical worlds.

The fourth of the questionnaire is prepared to learn how people react to integration of virtual and physical worlds and what they think about the borders of these two worlds. The project Trans-ports by Kas Oosterhuis also explained in the part 3.3.2.2 above. Quotation from the questionnaire:

> Trans-ports, by Kas Oosterhuis, is an example of architectural investigation on the edge of physical and virtual: “trans-ports are a programmable vehicle that connects the virtual to the real”.
>
> The flexible electronic skin follows the movements of the data driven structure. The skin not only displays the information of the tuning of the moment, but also lets the people interact with it. Trans-ports is the ultimate vehicle to offer valuable broadcast

time to its share holder's individual and collective interaction, creating a new bond between architecture and its users" (Oosterhuis, 2000)

The interior skin is a giant virtual window to a variety of global information sources like websites or web cams. The public is no longer looking at information, they are immersed inside information. Both the inner skin and the outer skin of trans-ports follow the changes of the data-driven pneumatic structure. Visitors of the www.trans-ports.com website navigate and manipulate the virtual structures, by playing the real time trans-ports game.

The reaction to scenario;

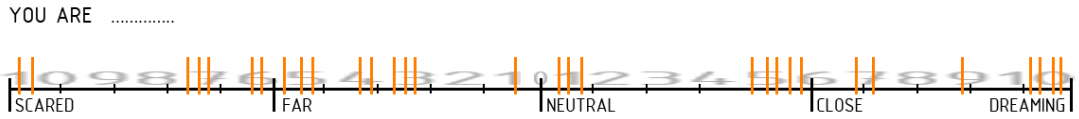

Figure. 3.27 The density of reaction to fourth page first question

These orange ticks in Fig.3.21 are showing the reaction levels of participants to the scenario they read. The density is showing that 55% are in positive side.

The question is asked to learn the reaction of the people to the scenario prepared for integration of virtual and physical and the borders of these two worlds. 39 % of the people are far to scenario. 27 % of the people are close and 16 % are dreaming about the scenario. 12 % are neutral. 3 % of the people are scared.

What people want;

The question is asked to learn what people want as integration of physical and virtual and its borders. 42 % of people want the integration as in the scenario. They want the both virtual and physical but integrated. None of the people want only a virtual house. 33 % of the people want no integration and 25 % are neutral.

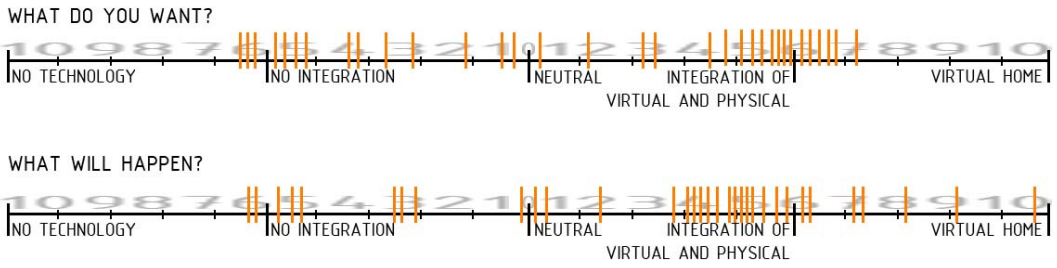

Figure. 3.28 The density of reaction to fourth theme first question

What people think will happen;

The question is asked to learn what people think will happen in the future ignoring their wishes. 51 % of the people believe in the future virtual and physical worlds will be integrated. They believe there will not be borders. 24 % believe there won't be any integration. 15 % are neutral. 10 % of the people also believe in the future we will have virtual houses.

Conclusion: The people who are far to this scenario, they do not want any integration but half of them believe it will happen in the future. And the people who are close to the scenario they want integration of virtual and physical without any borders and they believe it will happen.

In conclusion, people who are close and dreaming about transformation of the house in the third part of the questionnaire, they want and believe the transformation will occur as the integration of virtual and physical and there will not be any borders. On the other hand, the people who are far and scared of the idea of transforming the space, they are scared and far to the idea of integrating virtual and physical.

At the end most of the people believe integration will happen in the future. People who do not want any integration also believe it will happen in the future. None of the people want a virtual house but they believe it will occur in the future.

As architects we have to find answers of the question below.

How can we hide the borders of virtual and physical?

The Fifth Page

The fifth theme is **Information Societies**

The fifth part is prepared to ask questions to people about the life styles of the future and learn what people think about how information societies communicate with each other. Quotation from the questionnaire:

> The HYPERBODY project from Kas Oosterhuis is based on recent developments in architecture, building technology and ICT. Embedding ICT in the built environments implies that all building elements are behaving like birds in a swarm. They exchange data in real-time. They are aware of each other, they communicate with each other.
>
> Like Oosterhuis' project, in scenario prepared by ISTAG, urban infrastructure has been upgraded to support telematic transport and environmental management. The city is re-conceptualized as an organizational system work. In this scenario, ISTAG wanted to re-conceptualize transport network and real-time demand of goods distributed. The

character in this scenario makes plans for her travel this day and AmI helps her find a vehicle to share on that way by searching the trip database. In the car route, guidance system warns for traffic jams and calculates alternative ways with trip times. In addition, the system alerts the driver for potential accidents.

A networked system of devices at home and the environment is shown in this example like when the character in this scenario plans to make a dinner to her friends and needs a recipe, e-fridge gives her the recipe including the missing goods in this recipe and orders them to be delivered to the closest distribution point in her neighborhood. As described in the scenario “This can be a shop, the postal office or a franchised nodal point. All goods are smart tagged, so that she can check her virtual shopping expedition, from any enabled device at home, the office or from a kiosk in the street.” Even if the point is closed, she can take her goods from smart delivery boxes in this point.

This scenario assumes a radical redesign of the urban system, especially the transportation of people. The AmI here leads to a much more efficient and user-friendly urban environment.

In this part of the questionnaire, people are asked to answer the main question “How do people interact with each other in information societies?” with the scenario they read. Their reaction and their wishes are showing their answer to the main question.

<u>The reaction to scenario;</u>

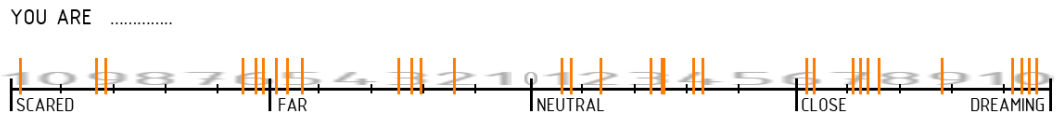

Figure. 3.29 The density of reaction to fifth theme first question

These orange ticks in Fig.3.23 are showing the reaction levels of participants to the scenario they read. The density is showing that 55% are in positive side.

The question is asked to learn the reaction of the people to the scenario prepared for information societies. 40 % of the people are neutral to scenario. 20 % are far. 15 % are dreaming and 15 % are feeling close. 10 % of the people are scared.

<u>What people want;</u>

The question is asked to learn what people want in the future as information societies. 45 % of the people are neutral about the future. 33 % want their house become a microcity and 10 % want virtual cities. 9 % of the people are against

information societies and they do not want further development. 3 % want to go back to middle age cities and communication technologies at that time.

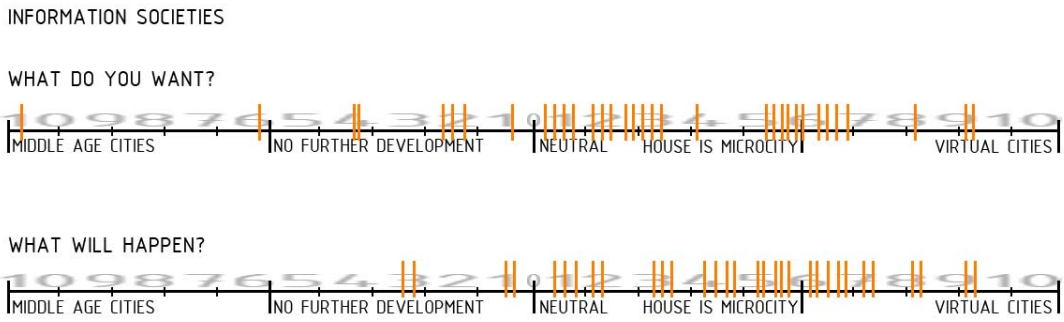

Figure. 3.30 The density of reaction to fifth theme first question

What people think will happen;

The question is asked to learn what people think will happen and how information societies live in the future. 67 % of the people believe that our houses will become microcities. 21 % are neutral about future. 6% believe there will not be physical communications and we will have virtual cities. 6 % believe that there will not be further development.

Conclusion: The people, who are scared, do not want further developments of technologies changing our lives but believe that our houses will turn into microcities in future. The people who are close and dreaming of the life in the scenario want and believe that it will happen in the future. The people who are neutral to scenario and what they want, also believe that in the future houses will turn into microcities.

In conclusion most of the people believe in the future our houses will be microcities and we will leisure, work and live in the same place.

As architects we have to find answers of the question below.

What new social relations does the information society produce?

4. CONCLUSION

Future? Isn't it certain that everybody has a different vision of future?

Architecture's love affair with technology helped me to imagine the future. This thesis focused on an unexplored meeting point of divergent themes like new technologies and architecture to figure out a vision of future of architectural space. It is clear that various configurations could have been possible in such an attempt. The attempt was to integrate pieces of personal and collective brainstorming on these themes for a general panorama.

So far, architecture is still meaningful in its traditional physical form. However, with the emergence developing technology like Digital Technologies, Information and Communication Technologies provides an opportunity for architects to explore and test out new architectural experiences.

Can this particular blend of divergent themes help us to attain a more creative mind to interpret and overcome this obscure period of future, and influence our mutual future with technology as architects?

Ambient Intelligence was the answer to search on these technologies to focus on transformation of space and imagine the new life styles growing with these technologies.

The main aim of AmI is augmenting environments and integrating physical and digital worlds. As architects we have to give more value to the space that surround us, we have to capture the opportunities given by AmI Technologies like flexibility and interactivity.

The big impact of ambient technologies on architecture is its ability to transform our experience of space totally.

The AmI approach intends to tie together ubiquitous computing, ubiquitous communication and intelligent HCI which brings to environment ability to analyze the context, adapt itself to the people and objects that reside in it, learn from their behavior, and eventually recognize as well as express emotions.

And AmI systems aim at augmenting real environments to create Smart Spaces where users are provided with pervasive virtual services.

What does it matter? Why we should care about this new kind of architectural and urban design issue? It matters because as mentioned by Mitchell (1995), the emerging civic structures and spatial arrangements of the digital era will profoundly

affect our access to economic opportunities and public discourse, the forms of cultural activity, the enaction of power, and the experiences that give shape and texture to our daily routines.

Why it concerns architects? According to the vision statement of ISTAG, “converge humans will be surrounded by intelligent interfaces supported by computing and networking which is everywhere, embedded in everyday objects such as furniture, clothes, vehicles, roads and smart materials even particles of architectural environment”.

How it will affect the space? The awesome buttons and menu options of present-day equipment will disappear, to be replaced by intelligent systems that we operate through user interfaces that are extension of our architectural space. Following this definition, buildings have to be connected with the technology embedded to it and have to be a part of information access circle.

If we understand what is happening, and if we can conceive and explore alternative futures, we can find opportunities to intervene, sometimes to resist, to organize, to legislate, to plan, and to design.

When we look from the view of technology producers, we saw researchers generating new ideas, technologies, and methodologies that support the creation of innovative products and services that satisfy the emerging and future needs of people as they live in their homes. We can look at any number of homes of the future via our always-on broadband connections. Whether it is MIT’s House_n, Philips’ HomeLab, Georgia Tech’s Aware House, or Ericsson’s intelligent condominiums, each offers compelling glimpses of what’s being researched now and what’s around the corner. These projects are prepared with more concern on technology then the architectural design. They did not concern about the life style and space which also will change after new Communication, IT and AmI Technologies.

With ambient technology, we learned new materials and new technologies from technology producers and new scenarios of future as discussed by Negroponte and Mitchell for years why do we have to think about a space, a house in the same and traditional shape?

How do we design a flexible and interactive architecture which can effectively support new life styles and communication functionalities and represents new technologies? To figure out the future of architecture we have discussed on examples of architectural spaces designed to adopt AmI and designed to support new life styles after AmI.

Space is no longer seen as fixed place surrounded by bricks and mortar, but rather as a virtual form which presents the structure of information. A statement by Schmitt (1999) supports this view. “Physical and virtual architecture have entered a state of symbiosis. Information has irreversibly expanded the dimensionsionality of architecture”.

As stated by Mitchell (1995), architects of the twenty-first century will still shape, arrange, and connect spaces (both real and virtual) to satisfy human needs. They will still care about the qualities of visual and ambient environments. They will still seek commodity, firmness, and delight. But commodity will be as much a matter of software functions and interface design as it is of floor plans and construction materials. Firmness will entail not only the physical integrity of structural systems, but also the logical integrity of computer systems. And delight? Delight will have unimagined new dimensions.

Another part of this research was the questionnaire to figure out the future of architecture. As the architects of the future, architecture students selected from different countries and backgrounds to answer a series of questions including different scenarios with different themes in each page. These questionnaire was a both-sided information sharing. In one way the aim was collecting information of participant’s ideas about technology and architecture and on the other way they saw the new examples of architecture shaped by developing technologies and it was good to confuse their minds with these ideas for their future products. The evaluation process end with different questions in minds shaped by participants’ fears, enjoyments and wishes.

- What can we do for getting away from the affair of big brother syndrome in the same time using these technologies and sharing information with everybody?

- With ambient technology, file to factory techniques, new materials and new design concepts, why do we have to think about a house in the same and traditional shape.

- Moreover, the space is no longer static, can it be transformed at will to meet different situations and serve different functions?

- How can we hide the borders of virtual and physical?
- What new social relations does the information society produce?

As architects we have to see that all these new technologies of information, communication and AmI will change our life style, the space and the city we live. We architects have to think about space supporting these inventions like Oosterhuis, Spuybroek, and his followers and design new life-styles embedded by AmI. Because they already tried to answer the questions above with their projects examined in this thesis.

As architects we have to discuss about the transformation of space after technological development. The space is no longer static; it's more dynamic and transformable.

REFERENCES

Cantoni, R., 2005. Bodyarchitecture: The evolution of interface Towards Ambient Intelligence, in *Ambient Intelligence 3,* pp. 213-219, Eds. *Riva G., Vatalaro F., Davide F., Alcañiz M.*

Castells, M., 1996. The Rise of The Network Society, Blackwell Publishers, London.

Chan, V., 2005. Plug and Play Design, *MSc Thesis,* TU Delft, Delft, Netherlands.

Frazer, J., 1995. An Evolutionary Architecture, Architectural Association Publications, London.

Gaggioli, A., 2005. Optimal Experience in Ambient Intelligence, in *Ambient Intelligence 3,* pp. 35-43, Eds. *Riva G., Vatalaro F., Davide F., Alcañiz M.*

Gausa, M., Salazar, J., Ferre, A., Sakamoto, T., Tetas, A. Prat, R. (Ed), 2004.Verb Matters**,** Actar.

Guallart, V., Cantarella, L. (Ed.), 2005. Media House Project**,** Actar/IAAC,

Ishii, H. and Ullmer, B., 1997. Tangible bits: towards seamless interfaces between people, bits and atoms. Proceedings of CHI'97, ACM *Press*.

Maes, P., 2004. Ambient Intelligence,
[http://ambient.media.mit.edu/research.html] (last visit 27.03.2006)

[http://courses.media.mit.edu/2005spring/mas961/] (last visit 27.03.2006)

Mitchell, W., 1995. City of Bits: Space, Place and the Infobahn, The MIT Press, Cambridge, Massachusetts, London.
[http://mitpress.mit.edu/e-books/city_of_bits] (last visit 23.07.2005)

Mitchell, W., 1999. E-topia, The MIT Press, Cambridge, Massachusetts, London.

Negroponte, N., 1995. Being Digital, Hodder & Stoughton, London.

Oosterhuis, K., 2003-a. Swarm Architecture,
[http://www.oosterhuis.nl/quickstart/fileadmin/Downloads/text/swarm_architecture.txt]

Oosterhuis, K., 2003-b. Hyperbodies, Towards an E-motive Architecture, Birkhäuser Publishers for Architecture, Basel

Oosterhuis, K., 2001-a. GameSetandMatch, *Conference paper,* Faculty of Architecture, Delft University of Technology, Delft, Netherlands, December 13th

Oosterhuis, K., 2001-b. E-Motive Architecture, interactive architecture in real time, *Inaugural speech,* Architectural Design at the Faculty of Architecture, Delft University of Technology, Delft, Netherlands, November 7th

Oosterhuis, K., 2000, Smart skin for Hyperbodies, [http://www.oosterhuis.nl/quickstart/index.php?id=260] (last visit 12.04.2006)

Philips Research, 2001, PML – Physical Markup Language, Philips Research Public Relations, Eindhoven

Philips Research, 2002, Ambient Intelligence in Homelab, Philips Research Public Relations, Eindhoven

Piva, S. and others, 2005. Flexible Architecture for Ambient Intelligence Systems Supporting Adaptive Multimodal Interaction with Users, in *Ambient Intelligence 3,* pp. 97-120, Eds. *Riva G., Vatalaro F., Davide F., Alcañiz M.*

Riva, G., 2005. The Psychology of Ambient Intelligence: Activity, Situation and Presence, in *Ambient Intelligence 3,* pp. 17-33, Eds. *Riva G., Vatalaro F., Davide F., Alcañiz M.,*

Riva, G., Lunghi M., Vatalaro F., Davide F., 2003. Presence 2010: The Emergence of Ambient Intelligence, in *Being There: Concepts, effects and measurement of user presence in synthetic environments*, pp. 60-81, Eds. *Riva G.*, IJsselsteijn W.A.

Schmitt, G., 1999.Information Architecture: Basis and future of CAAD, Birkhäuser Publisher for Architecture, Basel

Schmitt, G., 2001. Learning and Creative Collaboration, in *Bits and Space*, p.p 36-39, Ed. Maia Engeli, Birkhäuser Publisher for Architecture, Basel

Stille, A., 1998, Invisible Cities, *Linguafranca- The Review of Academic Life*, special issue: Technology or Treachery, July-August 1998

Weimer, M., 1995, The Computer for the 21st Century, *Scientific American,* 9, 78-89.

Zellner, P., 1999. Hybrid Space-New Forms in Digital Design, Thames & Hudson Ltd., London

[http://www.hariri andhariri.com/]
(last visit 17.04.2006)

[http://www.oosterhuis.com/]
(last visit 25.04.2006)

[http://www.natlab.research.philips.com]
(last visit 12.03.2006)

[http://www.research.philips.com/technologies/syst_softw/ami/fitnesscoach.html]
(last visit 17.04.2006)

[http://www.research.philips.com/technologies/syst_softw/ami/index.html]
(last visit 17.04.2006)

[http://www.research.philips.com/technologies/misc/homelab/downloads/homelab_365.pdf]
(last visit 12.03.2006)

[http://www.research.philips.com/technologies/digsoc/index.html]
(last visit 12.04.2006)

[http://www.research.philips.com/technologies/syst_softw/ami/background.html]
(last visit 27.03.2006)

[http://www.media.mit.edu]
(last visit 22.04.2006)

[http://www.fokus.gmd.de/bereichsseiten/geschaeftsfelder/smart_environment/index.php?lang=de]
(last visit 05.05.2006)

[http://tell.fll.purdue.edu/JapanProj/FLClipart/NounsThings.html]
(last visit 05.05.2006)

[http://www.research.philips.com/password/archive/23/pw23_ambintel_scen1.html]
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APPENDIX

The questionnaire made as a case study in this thesis work originally attached as an appendix.

This research focuses on the **possibilities offered by the emerging field of ambient technology**. The big impact of ambient technology on architecture is its ability to **transform our experience of space. Space is no longer static but reacts and interacts with its users**. It can be customized and transformed at will to meet different situations and serve different functions.
This research is more interested in the idea of house of future surrounded with these technologies. Searching for **people's ideas about their future** houses and the emerging technologies. Where they want to live, leisure and work? These technologies are showing us that **we can leisure work and live in the same place in future**.

Can you live, work and leisure in the same place? But the place is…….

Furniture
How people interact with prototypes of intelligent technology?

- Can all of the objects be connected to one another, without a hierarchy? Is the house a computer?
- Through what interfaces do you relate "intelligent houses"? How do you want to control the flows of information between physical and digital world?

Space
How people interact with prototypes of intelligent spaces?

- If the house is a place to leisure, how do you play at "1:1 scale"? What kind of entertainment you want in your home?
- Does the house have virtual windows in the form of natural or artificial landscapes?
- Can you think of spaces that modify their size in relation to their activity?

Societ
How people interact with each other in information societies?

- What new social relations does the information society produce?
- If the home is a place to live, work, leisure, shopping and rest, is the house a micro city? What do you think about a multifunctional house?

To help me answer these questions of our **future daily lives and architectural aspects**, please **put a tick on the question bar** to show **your reaction to scenarios**, **what you want about the subject** and **what you think this idea will become in future**.

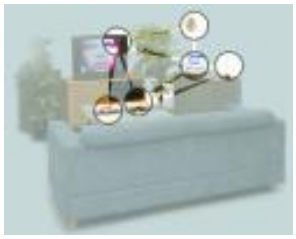
Thank you for becoming a participant of this research. CEREN HANCIOGLU

You Name / Departmant
…….....

The first theme: Networked Intelligent Objects






As ISTAG (IST Advisory Group) explain "**People in Information Societies** are surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects and an environment that is capable of recognizing and responding to the presence of different individuals in a seamless, unobtrusive and often invisible way".
Depending on developed versions of laptops, mobile phones and personal assistants, in the scenario prepared by ISTAG, characters are wearing "**p-com**" on their wrist. P-com is **dealing with ID and visa checks in airport, makes reservations of hotels, and rents car as owner's personality. The hotel rooms adopt the personality of its new guests. Room temperature and default lighting are set and there is a display of selected video and music choices on the video wall.**
In The MIT course Ambient Intelligence, students were asked to come up with new ideas and start innovative projects in this area. The daily life of information societies represented in their papers. Aaron Zinman describes the network with space and his wearable computer (BCI) like "**doors unlock themselves, objects and walls move when I need more space, and the lighting is always at the right level and direction. Because it is automatic, I never feel unease about the dynamism of my environment**"

Can all of the objects get connected to one another, without a hierarchy?

YOU ARE .....

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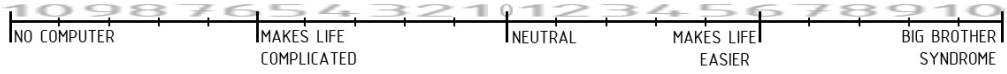
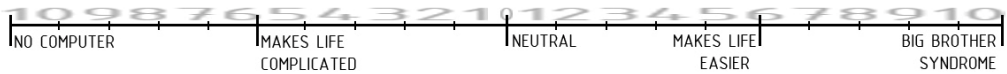
EMBEDDED TECHNOLOGIES, PERSONALIZED INFO AND PERSONALIZED SPACE

WHAT DO YOU WANT?



WHAT WILL HAPPEN?



The Second Theme: Concept Houses

Can all of the objects be connected to one another and to the space? Then is the house a computer?

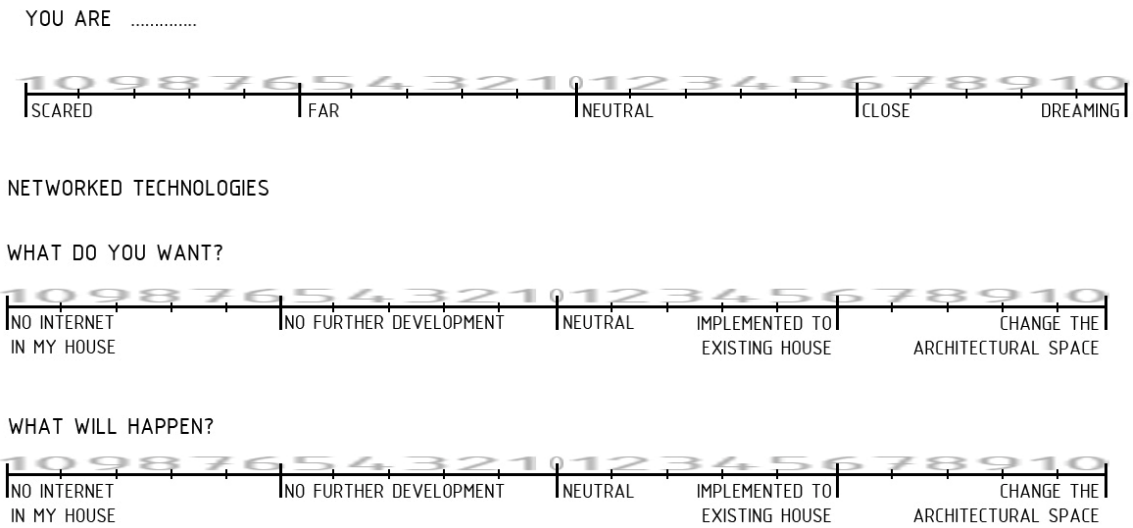
House_N is a Department of Architecture research group at the Massachusetts Institute of Technology that explores how new technologies, materials, and strategies for design can make possible dynamic, evolving places that respond to the complexities of life.

Hundreds of sensing components installed in nearly every part of the home. These sensors will be use to develop innovative user interface applications that help people easily control their environment. The sensors will be use to monitor activity in the environment so that researchers can carefully study how people react to new devices, systems, and **architectural design strategies in the complex context of the home.**

Change is accelerating, but the places we live are largely static and unresponsive.

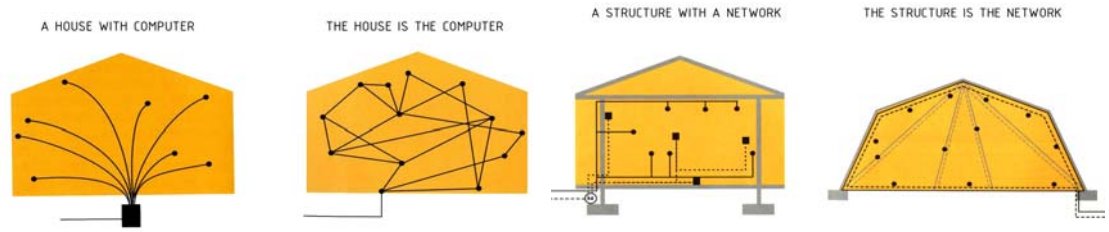
The big impact of ambient technology on architecture is its ability to **transform our experience of space.**

With ambient technology (file to factory techniques – new materials) and new design concepts (e-motive architecture, Trans architecture), why do we have to think about a house in the same and traditional shape?



The Third Theme: The transformation of house [a]

Media House Project; in order to build a prototype of an **informational house**, this project tests the progression of informational techniques beyond computers, and integrates it into everyday life. As they describe their project, **"The Metapolis architects have developed an informative structure, which incorporates in just one element--a house--the physical structure and electrical and data networks that enable a dynamic and configurable link between the entities (people, objects, space, limits, networks, contents) and that which create an inhabitable environment".**



The scenario of the Media House is,

1. World=City-House > If the home is a place to live, work, leisure, shopping and rest, is the house a microcity? How do we design a multifunctional house? How do natural, artificial and digital spaces interact?
2. Landscreens > Does the house have virtual windows in the form of natural or artificial landscapes?
3. Car room > Is the car another space for the house, connected to it and its environment? How do the streets interact and respond to intelligent cars?

The big impact of ambient technologies on architecture is its ability to transform our experience of space totally. Moreover, the space is no longer static. It can be transformed at will to meet different situations and serve different functions.

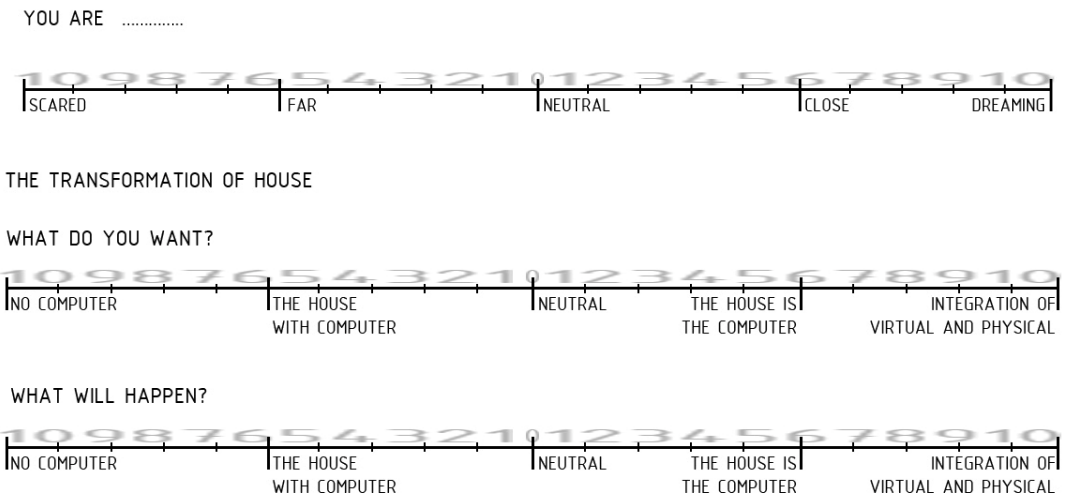
The transformation of house [b]

The physical products of cyber architecture we cannot see maybe but it is changing the way of thinking of architecture and open minds for hybrid spaces. Many of the architects are thinking about and making projects for our future.
Hariri&Hariri explore the nature of domestic **space in the future** by examining the **virtual and physical**, **supported with new technologies and existing in space that accommodates how our feelings change.**
House is organized around a **Touch Activated digital Spine**, **liquid with a global network of databases.** They designed the spaces **as units plugged in the digital spine** and designed the inside of this space, as the living room is where the entertainment takes place **(media room)**. Any movie or TV program is accessible globally and could be watched at a touch.
The **office/work spaces** have liquid drafting wall instead of the individual monitors and **children's work/class rooms** are connected to the schools around the globe.



The kitchen/dining room operates as a laboratory with a long working counter also plugged into the spine. One can prepare the meal with the help of a **virtual chef from a favorite restaurant** and have a dinner with a virtual guest or friend through the liquid wall.
They also think about the landscape surrounding the building. **The virtual landscaping** can offer many possibilities throughout the house.

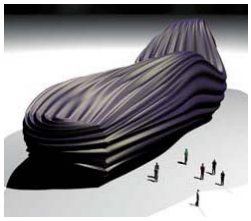
> "The infiltration of electronics into the vocabulary of building brings with it the capacity for connection, not only of all systems within the building, but also of the building itself to the surrounding world. As a media skin for occupants, the identity and character of the house evolves as it responds to, and stores data from, the needs and the use patterns of the occupants." (Hariri&Hariri)



The Fourth Theme: Borders of physical and virtual

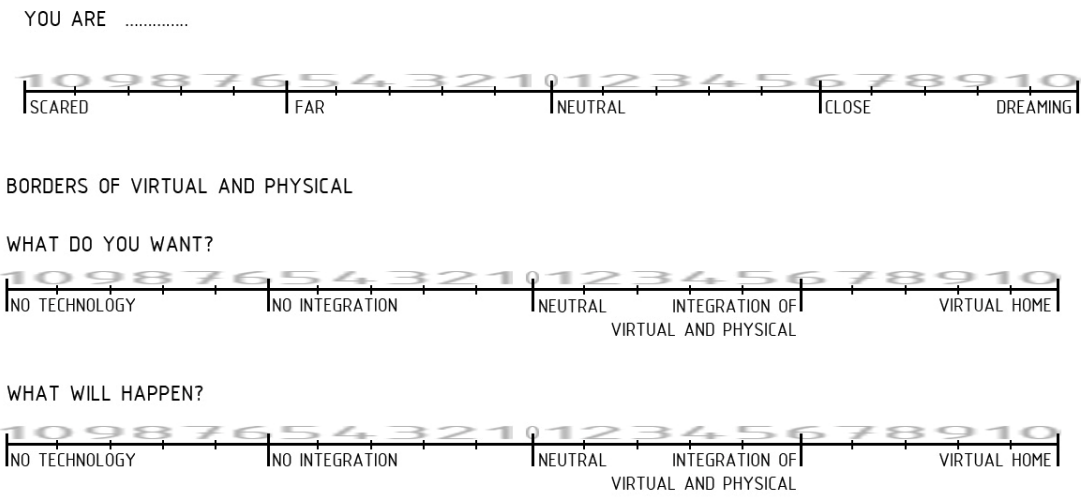
Trans-ports, by Kas Oosterhuis, is an example of architectural investigation on the edge of physical and virtual: "**trans-ports are a programmable vehicle that connects the virtual to the real".**

The flexible electronic skin follows the movements of the data driven structure. The skin not only displays the information of the tuning of the moment, but also lets the people interact with it. Trans-ports is the ultimate vehicle to offer valuable broadcast time to its share holder's individual and collective interaction, creating a new bond between architecture and its users" (Oosterhuis, 2000)




The interior skin is a giant virtual window to a variety of global information sources like websites or web cams. **The public is no longer looking at information, they are immersed inside information.** Both the inner skin and the outer **skin of trans-ports follow the changes of the data-driven** pneumatic structure. Visitors of the www.trans-ports.com website navigate and manipulate the virtual structures, by playing the real time trans-ports game.

How can we hide the borders of virtual and physical?

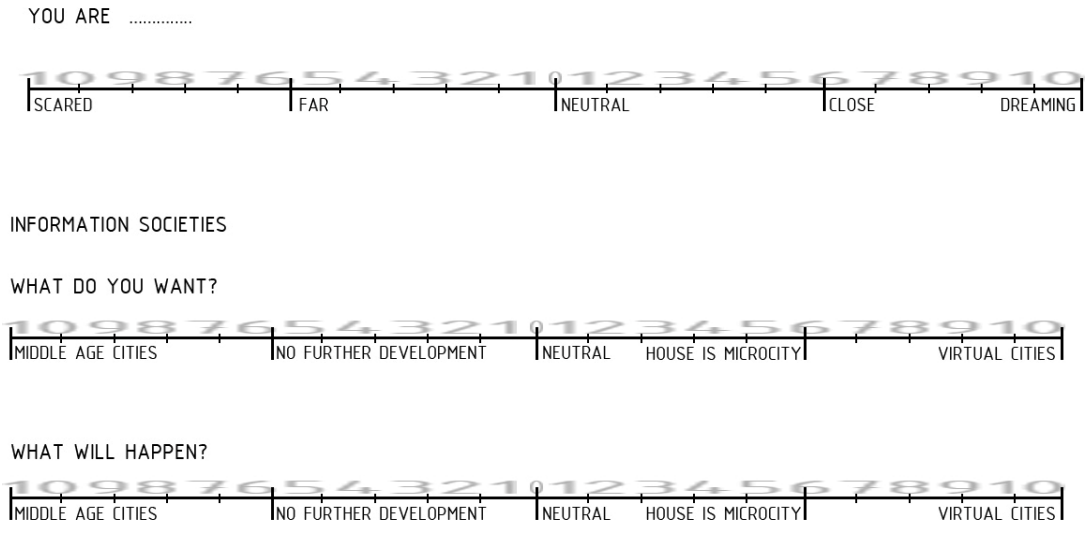


The Fifth Theme: Information Societies

The HYPERBODY project from Kas Oosterhuis is based on recent developments in architecture, building technology and ICT. Embedding ICT in the built environments implies that all building elements are behaving like birds in a swarm. They exchange data in real-time. **They are aware of each other, they communicate with each other.**

Like Oosterhuis' project, in scenario prepared by ISTAG, urban **infrastructure has been upgraded to support telematic transport and environmental management. The city is reconceptualised as an organizational system work.** In this scenario, ISTAG wanted to **re-conceptualize transport network** and **real-time demand of goods distributed**. The character in this scenario makes plans for her travel this day and AmI helps her find a vehicle to share on that way by searching the trip database. In the car route, guidance system warns for traffic jams and calculates alternative ways with trip times. In addition, the system alerts the driver for potential accidents.
A **networked system of devices at home and the environment** is shown in this example like when the character in this scenario plans to make a dinner to her friends and needs a recipe, e-fridge gives her the recipe including the missing goods in this recipe and orders them to be delivered to the closest distribution point in her **neighborhood**. As described in the scenario "This can be a shop, the postal office or a franchised nodal point. All goods are smart tagged, so that she can check her **virtual shopping expedition**, from any enabled device at home, the office or from a kiosk in the street." Even if the point is closed, she can take her goods from **smart delivery boxes** in this point.
This scenario assumes a **radical redesign of the urban system**, especially the transportation of people. The AmI here leads to a much **more efficient and user-friendly urban environment**.

How do people interact with each other in information societies?
What new social relations does the information society produce?



BIOGRAPHY

Ceren Hancıoğlu was born in Bursa in 1981. After graduating Süleyman Demirel Science Highschool in Afyon in 1999, she started her study in Istanbul Technical University. She got her BArch in 2003, in the same year she started her MSc in Architectural Design Programme in Science and Technology Instıtute in ITU. In the period of 2005-2006, she continued her work in Eindhoven Technical University in Netherlands. She participated to national and international workshops in Berlin, Amasya, Afyon and Istanbul. She participated national competitions.

1.Mention Prize from İstanbul Naval Museum Architectural design competition in 2005,

1. Mention Prize from Gaziosmanpaşa Municipality Community Center and Public Spaces Architectural and Urban design competition in 2004,

Encouragement Prize from Selçuk Pananos Beach Urban and Landscape design competition in 2004.